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Ore Dressing in the Coeur d'Alene District—III

Workmanship in Mills Good. Crusher Plants Designed for Capacity. Roll Practice Fair. Movable Pillow-block Roll Best Adapted to Conditions

BY EDWARD S. WIARD*

It is seen from the preceding sections of this article that, while the mills in the Cœur d'Alene district are situated on hillsides the floors do not rest upon terraces cut out of them. The Hercules is an exception, the floors to a large extent being laid on earth terraces fronted with retaining walls of masonry. In the majority of cases the posts of the frame and walls arise from the alluvium at the bottom of the hillside, or, as in the case of the Bunker Hill mill, from the ground, and the hillside must be regarded as forming the rear side of the building. The hillsides proper furnish support for the bins and crushers only. In laying the foundations of the majority of the mill structures longitudinal trenches were cut, the bottom being filled with concrete. On the concrete 12x12 timber sills were laid and from these arose the posts, so disposed as to occupy the corners of rectangles from 14 to 20 ft. on a side. In Fig. 2 is shown how one vertical unit arises through the mill. It will be understood that there are four braces to a post at each level, only two being shown in the diagram. The lower posts are invariably 12x12 in.; above the trommel line 8x8-in. posts are employed.

The 8x8 system is built up to such hights at the various bents as to give the usual quarter pitch to the roof when the roof joists with their boarding and shingles are laid upon them. Gabled roofs supported on queen trusses are to be seen at the Standard and Mammoth mills and a few of the secondary structures. A feature of the Standard and Mammoth roofs is the employment of dormer windows. The sky line of the usual quarter-pitched

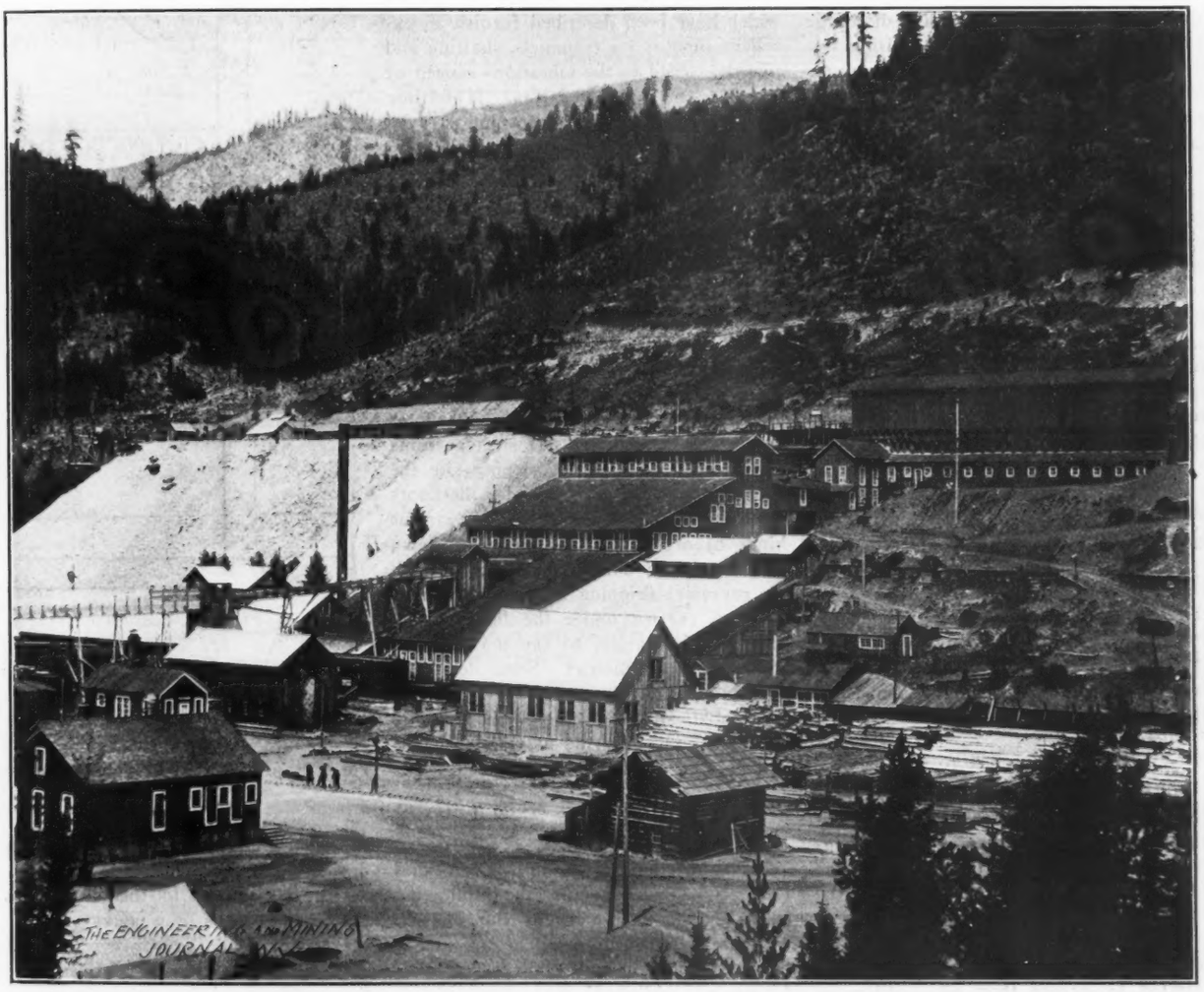

FIG. 1. THE MORNING MILL, COEUR D' ALENE DISTRICT

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shingled roofs which, it will be understood, slope with the long axes of the mills, is not infrequently dropped at convenient points to permit of a range of windows Skylights are never employed. The roof of the main mill structure always covers the roll bin and sometimes a portion of the front of the receiving bin, as, for example, at the Last Chance mill, or the whole of it as at the Hercules mill. The roll bin almost invariably occupies the whole width of the mill building.

General Mill Framing and Foundation Design

Fig. 2 is a purely diagrammatic drawing and not a scale detail from any particular mill. At the level at which a floor section is shown in detail would be placed the jigs. Jig floors have a slope of ¼ in. to the foot to permit of hosing into the drains. The drains usually discharge into the housing of elevators raising fine ore. Floors are usually double, the upper surfacing being 1½- to 2-in. lumber. Local pine from the region adjoining lake Cœur d'Alene is generally used. Douglas fir or Oregon pine is used particularly in bin construction, or where large sticks are required. Imported Belgian cement is much used for foundation work. In making the walls of the structures, 12x12 wall plates are used, and spacings from 14 to 20 ft. filled in with 2x4 or 4x6 studding. A double window is placed between each pair of wall plates. To the studding and wall plates is spiked the cover consisting of two thicknesses of 1-in. boards usually laid vertically, although occasionally the inner shell is laid diagonally to increase the stiffness of the frame. Battens cover the edges of the boards of the outer shell. Most of the retaining walls fronting terraces and supporting bins are built of slabby pieces of quartzite quarried from the nearest accessible bluff. Sand for construction in mills already in operation is obtained from the tailings from the fine jigs. The coarse tailings make excellent concrete.

Grease Superior to Oil

For supporting shafting plain boxes provided with screw-top grease cups are gaining in favor in the district. Cast-iron cups are better than brass as the threads of the latter are very easily stripped. With the exception of the dynamo or motor there is no machine or journal about a concentrating mill which cannot better be lubricated by grease than oil. Oil is a very wasteful lubricant when used with plain boxes, and if ring oilers are placed on shafting the wells either fill with a muck of oil and dirt, or if kept in good condition they take up too much of the oiler's time. At the best the results secured from them are no better, probably inferior, to the results obtained from plain boxes with grease cups, and the first cost is greater. The grease which presses out at the ends of the boxes is a very efficient guard against the entrance of grit. The rapidity with which the flames spread in the fire which destroyed the old Morning mill was attributed to the saturation of the timbers with oil from the shafting boxes. On rebuilding the mill grease cups were used throughout.

Such, briefly described, are the methods of construction and arrangement of the mills. The workmanship in the framing is always excellent and the construction of the machines about the mills, as for example the elevators, shows remarkable technical skill and knowledge. Other details of construction will be dealt with in the sections which follow. Owing to subsidence of foundations under heavy weights and heavy vibrations or insufficient footing for the columns, some of the mills have been bothered by shafts getting out of line. While the frames which have been described furnish an excellent support for trommels, shafting and jigs they yield to the vibrations caused by vanners and Wilfley tables. If settling tanks are supported by the frame at even so short a distance from the ground as 10 ft. the vibration is sufficiently great as to seriously interfere with settling and classification. Indeed I am of the opinion that, all things considered, a steel frame with concrete floors partially laid on the solid and partially suspended would more adequately assist in coping with the mill problems than the wooden construction now in vogue. It would have the stiffness that the wooden frame lacks, and, contrary to general belief, it would be warmer in winter and cooler in summer. If such a frame were placed on a gently sloping site the launders could be carried under the floors in roomy conduits, retreatment of various kinds of ore being kept ahead or down the mill. The dark, damp corners with the pervasive dripping from multitudes of launders carried under the floors are a disagreeable feature, to say the least, of the mills of the district. Some details of construction are best made of wood; this is emphatically the case with trommel housings.. The securing of wooden members to steel offers no great difficulties.

Costs in Mill Construction

In connection with mill-frame and foundation construction the following costs are about typical of the district. Undressed local lumber fetches about $16 per 1000 laid down at Wallace; for surfacing an additional 50c. per side is asked. The imported Belgian cement costs $4.70 per bbl. at Wallace in carload lots. For loading and hauling 75c. per ton-mile is a fair estimate and a two-horse team costs $9 per day of nine hours. The eight-hour day is in vogue. Mill carpenters receive $4 per day; laborers $3. In general the cost of erecting and equipping mills ranges from $200 per ton of capacity in large plants, to $300 per ton in smaller ones.

Ore Bins and Gates

The typical mill-bin construction of the district is shown in Fig. 3. The crusher is placed, with its bell or hopper in the floor under the chutes, in the center of the four left-hand chutes and the ore from them passes over four grizzlies with a slope of 9 in. to the foot. The usual wear of the grizzlies at the center binding rod is shown in Fig. 4 in which dotted lines show the original outlines of fittings. This is an excellent example of

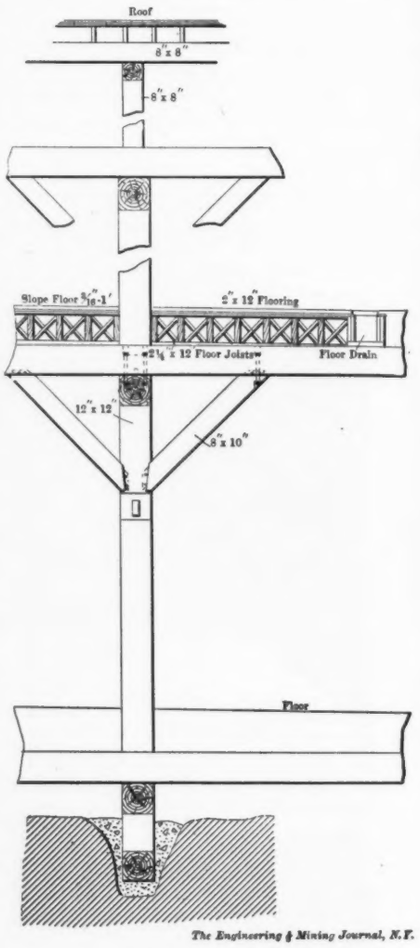


FIG. 2. VERTICAL UNIT OF INTERIOR OF COEUR D' ALENE MILL

the wear of iron where the direction of flow of ore is changed.

Ore is brought to the crusher from the other hoppers by a conveyer belt. At the crusher end the conveyer discharges on a grizzly, the oversize feeding into the crusher. Below the crusher the streams of undersize and oversize join and pour on a conveyer belt whose direction of travel is nearly at right angles to the long axis of the receiving bin. This conveyer discharges into the roll bin. The lower conveyer is covered with a narrow shed. The front of the receiving bin is covered with a lean-to shed, the upper part of the bin being exposed. A shed, with sheathing of corrugated iron and with sufficiently high openings at

either end to allow the passage of a standard-gage engine, covers the top of the bin. Every other tie on the top of the bin is cut out to allow the ore to fall into the bin. The bottom of the bin is not lined. Wear on the top timbers due to the impact of ore is serious here as elsewhere in the district. The usual protective device for these timbers is a plank or timber nailed to the top of the cross timbers. These makeshifts do not, however, protect the sides of the timbers. A better device would be a chilled casting with sides and pointed top and secured by lag screws or bolts. At the Bunker Hill rock house pieces of old trommel plate have been nailed to the cross timbers. The Mammoth bin shown rests upon a terrace cut out of the solid rock, the surface being trued with concrete. This a good feature as decay of the sill timbers invariably follows where bins rest on gravel benches.

Inverted Lake Superior Gates used

The usual gate for the bins is one or more boards with handles held by cleats in the chutes. By worrying these boards against their rests the bin tender produces a more or less steady flow of ore on the grizzlies or the conveyer belts. At the storage end of the Morning receiving bin the discharge ends of the chutes are closed by boxes hinged into the sides of the chutes, the front end being supported by levers which are overhead. When the chutes are closed the other end of the lever rests under a stud fastened to the wall of the lean-to shed. Cars are filled at the chutes and dumped into the hopper over the crusher. At the Last Chance mill in addition to chute boards there are rack and pinion gates. At the Bunker Hill rock house the bins are provided with curved sheet-steel gates which seem to be a curious inversion of the Lake Superior gate. Fig. 5 illustrates the principle of this gate. The diagram shows the gate in the closed position. To open the hand wheel is turned clock-wise while facing it. In the wide open position the steel surface *a b c d* forms a portion of the bottom of the chute which is cut out so as to allow it to be depressed. A partial rotation of the hand wheel opens or closes the gate and it will be seen that it is impossible for ore to jam it. In the Bunker Hill gate the axis *b c* is raised above the stream of ore discharging from the chute and the gate is closed by forcing an edge corresponding to *f e* down through the stream of ore. In the closed position the lower edge of the curved shield rests upon the bottom of the chute, the bottom of which is not cut out. Despite the difficulties attending the complete shutting off of the ore with the Bunker Hill gate it is probably better for regulating the flow of the ore but no better than an ordinary chute board. The Lake Superior gate is best adapted to filling cars but it might with advantage be placed back of chute boards. The ordinary rack and pinion gate is an abomination.

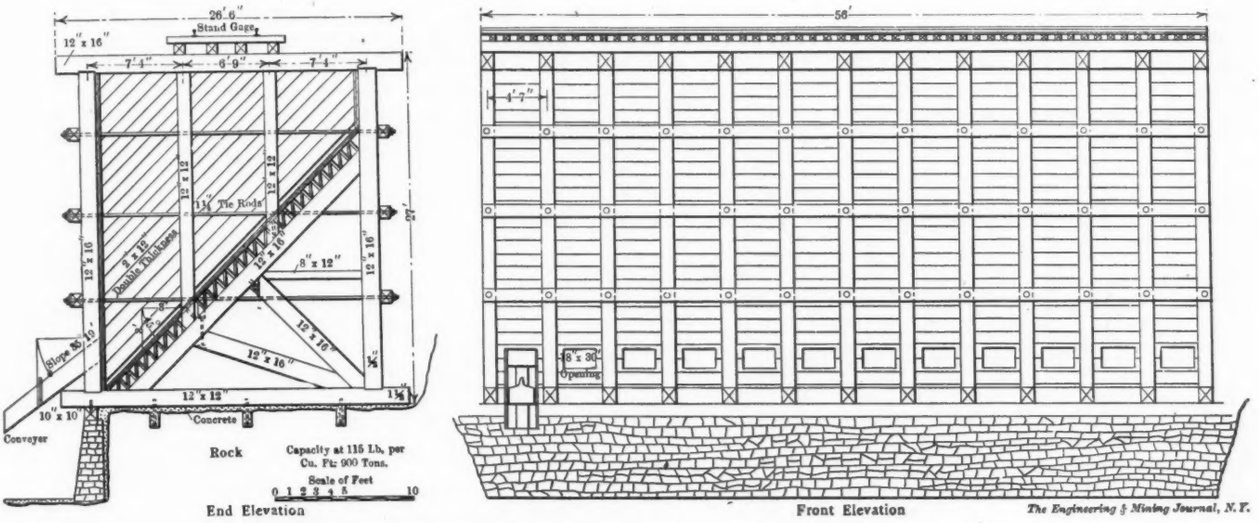


FIG. 3. RECEIVING BIN OF THE MAMMOTH MILL

Conveyers

With the exception of that connecting the rock house and South mill of the Bunker Hill Company and a portion of the one at the Last Chance the conveyer belts are very nearly flat; the Mammoth mill belt for example has a slope of but 6 deg. The typical conveyer belt used in the district is a flat cotton belt of 8-ply thickness, 14 or 16 in. wide and provided with steel flights at either side in the manner shown in Fig. 6. The flights are secured to the belt with elevator bolts. The belt travel is low, 150 to 160 ft. per min. The belt is supported by 5-in. cylindrical idlers made of pipe or wood placed 18 to 24 in. apart. This style of conveyer is preferred to the troughed form and has in some cases replaced it. In point of repairs and length of life it appears to be superior to the troughed belt. At the picking plants which have been described, and connecting the rock house of the Bunker Hill company with the mill are flat rubber belts with slight lips. The slope of the Bunker Hill belt is 19 deg. 45 min., the belt is 24 in. wide and of 8-ply thickness and supported by idlers of 5 in. diameter set 12 to 14 in. apart. The shafts are steel pins driven into the wood. The ore fed to the belt is 1½-in. size and smaller and manifests no tendency to roll back. There is, however, considerable adherence among the damp ore particles.

Rock Breakers—Features of Operation and Construction

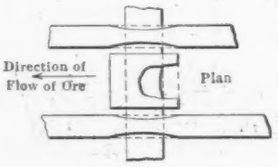
Only very exceptionally will the largest pieces of ore received from the mines fail to enter the opening of a 9x15 crusher of the Blake type. The ultimate reduction by breakers is to a maximum average size of 1½ in. In the larger mills only is more than one machine used to effect the comminution and in these the plant was apparently installed with the view of obtaining capacity rather than preserving low ratios of crushing.

Owing to the more or less circular grouping of the grizzlies about the hoppers of the gyratory crushers, in vogue in a number of the mills, it is impossible to rotate the hopper so that the arms of the spider will not receive the impact of ore. Many of the spider arms are badly worn in the manner shown in Fig. 7. The dotted lines in the sketch show the original out lines of the arms. It would seem that the providing of an adjustable armor for the spiders is a matter worthy of the attention of the makers of gyratory crushers. At the Bunker Hill rock house I saw a protecting device for a three-armed spider consisting of a heavy ring which fitted over the spider body and three arms fastened to the ring to which were riveted steel saddles which fitted over the spider arms. This armor was held in place by its weight. In a number of the mills the hoppers of the crushers are protected by

gores of chilled iron, Fig. 8. The gores are held in place by bolts passing through the edge of the hopper.

At the Standard mill zinc for setting concaves is melted in a ladle of about 5 gal. capacity supported over the fire of a forge by a half-ton chain block. The forge which is situated about 20 ft. in front of the crushers is made of a section of trommel plates and blast is supplied by a small blower driven by a Pelton wheel. The chain block is secured to a crawl placed at a sufficient hight to allow it and its load of melted zinc to be rolled over the crushers. At the Federal companies' properties where gyratory crushers are used grease has successfully been substituted for crusher oil. The grease is introduced into a piece of 4-in. pipe which, with the elbow at the lower end, is 31½ in. long. At the elbow the pipe is reduced to 1-in. size. This pipe is screwed into the bottom of the crusher under the eccentric and the junction at that point supports the whole device. The 4-in. pipe stands out from the side of the crusher and is slightly inclined to the vertical. At its upper end is a screw cap which is tapped and threaded for a ¾-in. screw stem. The upper end of the screw stem is provided with a hand-wheel and the lower end with a disk. As will be readily seen from the foregoing description, the device is simply a long grease cup.

FIG. 4



GRIZZLEY BARS AND WASHERS

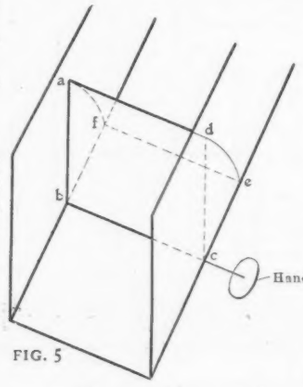
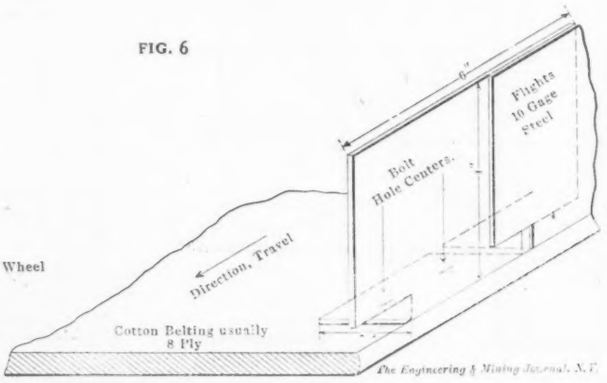


FIG. 5

ROTATING GATE CHUTE

FIG. 6


Flights 10 Gage Steel
Belt Hole Centers
Direction, Travel
Cotton Belting usually 8 Ply
The Engineering & Mining Journal, N.Y.

METHOD OF ATTACHING FLIGHTS TO CONVEYER BELTS

Blake Crushers In General Use

The common size of breaker of the Blake type used in the district is a 9x15. In the catalogs of the makers of this type of machine a very curious difference of opinion as to their capacity is to be found. Under columns headed "Capacity to 1½ in." in tabulated statements as to sizes, weights, etc., are given tons of rock per hour, and this figure varies all the way from 5½ to 15. There is always the statement that the capacity will vary to some extent with the character of the rock fed, i.e., whether the rock breaks with a snap or merely mashes. How these figures are obtained, and what they really represent I do not know.

The proportions of a crusher have a great deal to do with its capacity. Consider the case of a piece of rock or ore which is touching both plates at the end of the stroke, or when the plates are closest together. The amount which the piece of rock will drop between the jaws preparatory to being crushed will depend, first, on the angle between the plates (the more acute this is the greater the drop), and second, on the amount of the stroke (the greater the stroke the farther the piece will drop before being nipped by the return of the movable jaw). Of course, the greater the downward movement at any point the greater the capacity. In the sectional diagrams shown in the catalogs the jaws are always shown full of rock grading from the finest at the mouth to pieces occupying the whole width of opening at the top. If a crusher is filled up with coarse rock it will stall frequently or throw off the belt. To borrow an analogy from roll theory the feeding must be regulated to give free crushing rather than choke crushing. When the crusherman shoves a large piece of rock into the jaws of the crusher he has to wait until it has broken up into a number of pieces before feeding any more. The other principal factor affecting capacity is the area of discharge opening.

In the Cœur d'Alene mills the largest pieces of rock fed to the crusher will be nipped near the top of the usual 9x15 opening, and to make the width of opening greater than nine inches would add very little to the capacity. In the catalog capacities are roughly proportional to the area of the receiving opening. Now, from my point of view breadth of opening increases the capacity far more than greater width. If the millmen of the Cœur d'Alene could purchase a series of Blake crushers with openings ranging from 15 to 28 in., the width remaining constant at 9 in., they would be in a better position to cope with the breaking problem than they are at present. In many camps the size of the ore brought to mills from the mines is about the same as in the Cœur d' Alene, so the foregoing statement is of general application.

If the rock from the mines were of such a size that a 12x15 opening were needed and such a size crusher were manufactured, other factors such as angle of jaws and stroke remaining the same, the capacity would be but little greater than that of a 9x15 crusher receiving 9-in. rock. The fines settle in the jaws much faster than the rock yet unreduced to the limiting size. The amount of rock which can be put through a crusher is limited not only by the belt coming off or the crusher stalling. Long before this point is reached ominous happenings occur: The crusher runs hot and the babbitt wears out rapidly; the caps of the swing-jaw bearings loosen frequently; the edges of the toggle seats give away. With rock of a maximum size which will just enter and be nipped by the jaws of the crusher, and from which undersize below 2-in. ring has been removed, I believe that, under Coeur d'Alene conditions crushing to 1½ in., the maximum safe capacity of a cast-iron, 9x15 Blake crusher is reached at nine tons per hour. In the district, with periods of rest, the Blake forms of crushers are fed through the whole 24 hours. The periods that the crusher is running empty probably amount to about 4 hours out of the 24; the proper amount to feed is consequently 180 tons.

Comparatively long strokes are the rule and these are obtained by lengthening the pitman. A couple of simple diagrams in which two pitmen of different length and toggles and jaws are represented by straight lines, the beginning and end of the stroke being obtained by striking arcs with a compass, will make this clear. The increased capacity thus obtained is at the expense of a considerable variation in size of the product. The No. 1 rolls never have any return of oversize and are consequently capable of taking care of the largest amount of rock from the crusher as well as nipping pieces which exceed 1½ in. in size. By reducing the stroke of a Blake crusher it is possible to make a product comparable to that from a Dodge crusher. As was remarked above, fines either made by crushing or in the ore fed to the crusher readily work down through the mass of rock in

the jaws; and if run-of-mine ore is put directly into the crusher without screening in a grizzly, startling tonnages can be put through Blake crushers even as small as the 9x15 size. At one of the old mills of the district the rate of feed in this size machine was 20 tons per hour, or 400 tons of unsized ore per day of 24 hours. The ore was rather softer than any which is mined in the district at present. During high-water periods this mill was run entirely by a single Pelton wheel. Governing of the speed of the machinery was entirely done by the crusherman. He was chosen for his huskiness and ability to keep his eyes glued on a certain shaft pulley in front of the crusher. The rule he followed was, "Jam the crusher with fines and feed lightly with coarse rock." The most successful of these human governors, I believe, is still living in the district and, at the last account, prospering.

free the water from grit. At the Hercules mill curved toggle plates are employed. It is claimed by the foreman that these will break before the pitman if a hammer head inadvertently falls into the crusher.

Roller Mills

The practice of the Cœur d'Alene district in respect to roll speed is shown in the accompanying table. The theoretical capacity of the rolls is based upon a weight of 115 lb. per cu.ft. of broken ore. The actual tonnages given as passing through the rolls are approximate estimates made by me. The column headed "R. P. M., Argall," is obtained from data furnished by Philip Argall in his paper, "Sampling and Dry Crushing in Colorado." Argall's figures were obtained from a large experience gained in crushing Colorado ores of widely varying character.

SPEED AND CAPACITY OF SOME COEUR D'ALENE ROLLS.

	Size.	R.P.M.	R.P.M. "Argall."	Dia. Largest Piece, Approx., In.	Width Roll Opening, In.	Tonnage 24 Hours Estimated.	Theoretical Ribbon, Tons 24 Hours.
B	14x38	50	37	1½	¾	500	3242
C	14x36	56	46	¾	¼	300	1062
D	14x36	85	63	½	1/16	175	404
E	14x36	55	40	1½	¾	90	2086
F	12x36	84	35	1½	¾	400	4097
G	12x36	40	46	¾	¼	250	650
H	16x30	60	51	1	½	150	2601
I	14x30	67	64	½	¼	150	526
J	10x30	81	76	½	1/16	100	229
K	12x24	58	80	½	¼	150	315

Remarks—Column 8 gives theoretical tonnage per 24 hours with roll speed given in column 3. *C*, wet crushing coarse-jig middlings; *D*, wet crushing fine-jig middlings; *E*, wet crushing coarse-jig middlings; *B* and *F*, dry crushing whole feed to mill; *G*, *H*, *I*, *J* and *K*, wet crushing jig middlings.

Grease Best Lubricant for Crushers

I consider that grease is a better lubricant for the pitman and frame bearings of a Blake crusher than oil and that it is better brought into contact with the shaft by large grease cups than wells. In applying grease cups to a crusher made with lubricating wells, the upper portion should be filled with babbitt and a hole drilled and tapped to receive the grease cups. After drilling and tapping a shallow waste well for oil-lubrication, grooves for distributing the grease should be made in the babbitt of the cap and base of the frame bearings and in the top and gib babbitt of the pitman. I also prefer coiled springs to cylindrical blocks of rubber at the end of the spring rod; the latter under repeated flexure quickly lose their elasticity. For medium-sized crushers a spring made of ½-in. rod coiled into 10 or 11 coils of 1-in. pitch and having an outside diameter of about 4 in. will furnish the proper tension for keeping the toggles in place. Coiled springs are used exclusively in the mills of the district. The excellent water-drip device, recommended by Earle C. Bacon, of the Farrel Foundry and Machine Company, for keeping the grease in the pitman and bearings cool and stiff is not used in any of the mills. In resorting to it extra precautions should be taken to

Under the head of remarks it will be seen that the majority of the rolls selected as exemplification of the district practice do wet crushing. The two sets of roll speeds given are, therefore, not quite comparable though they should be very nearly so when the feed to the rolls is thoroughly dewatered. Argall's data are certainly founded on sound conceptions and are the most complete available to the engineer. My reason for introducing this tabulation is to show that no theory of roll speed has been evolved by the district, each mill being a law unto itself in this respect.

Three Causes for Mediocrity of Results

Taken as a whole the roll work exhibited here is not very impressive. This cannot be attributed to poor workmanship in the machines used, rolls of standard make being employed in all the mills. Some of the contributory causes to the poor showing are: (1) Experienced men are not employed to operate the machines or their operation is left to the jigmen who are too much occupied with their regular duties to give them proper care. (2) In wet crushing adequate dewatering devices are not used above the rolls. (3) In fine crushing only partial choke crushing is practised. (4) The rolls are often set in dark, inaccessible locations.

Dewatering Devices Not Satisfactory

With respect to the second point I found that two types of dewatering device are used in the district, namely, shaking feeders with screens and false bottom, and small plug tanks of V-shaped cross-section. The former type is generally used for coarse middlings, the latter for the finer sorts. With moderate amounts of water and feeding coarse pieces of ore the shaking dewaterer may be very successfully employed, and an example of this may be seen at the Mammoth mill. Here, over the No. 3 set of rolls which receives coarse-jig middlings ranging in size from 4 to 10 mm. and the low-grade hutch sands from jigs receiving a feed ranging in size up to 6 mm., is a

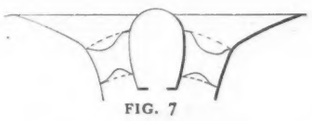


FIG. 7

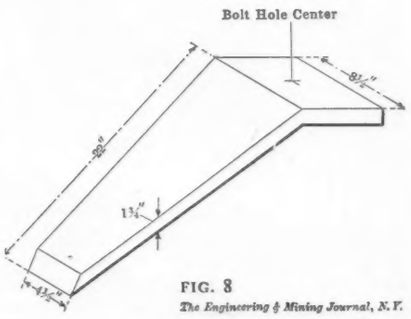


FIG. 8

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GORE OF CHILLED-IRON HOPPER FOR GYRATORY CRUSHER

shaking dewatering device the appearance and mode of operation of which may be gathered from the following description.

The feeder with screen and false bottom is supported at the four corners by rods. These rods at the lower or feeder end are bent into hooks or eyes which surround the ends of two transverse rods secured to the under side of the feeder. Four studs support the upper ends of the rods and these are bent around them as on the transverse rods below. The front rods or those nearest to the rolls are longer than the rear ones to an extent that gives the feeder a slope of about 4 in. to 1 ft. The feeder and supporting rods rock on the supporting studs. Motion is first given by an ordinary jig eccentric to a rocker shaft which is connected with the eccentric by a lever and rod. The lever is firmly fixed to one end of the rocker shaft. At the other end is a second lever which is connected to the feeder pan by a rod. For regulation of the length of stroke of the feeder the second lever is slotted and provided with a slide. To a pin passing through this slide is secured the rod, the other end of which is secured to the feeder. A vertical rod

is also secured to this pin and terminates at a third lever. Depression of this third lever and the slide of the second one below is effected by a long horizontal rod connected to a vertical hand lever on the jig floor. In front of the lever handle, so that it may be grasped by the fingers while the palm is on the handle, is a spring pawl which engages in the teeth of a curved rack. When the slide in the second lever is depressed the stroke of the feeder is diminished and is increased by a reverse movement. The efficiency of such a device diminishes as the size of feed and the feeder decrease. If used for fine ore, when the screen is new, water will pass through the bed of ore and screen with a fair degree of freedom, but the very performance of its function quickly brings the dewatering to an end. When the water leaves the bed of ore in the feeder the ore is left in a pasty condition due to coherence of the damp grains of ore, the amount of such coherence being inversely proportional to the size of the grains. In this condition it very readily fills the small holes of the screens. Ultimately the screen becomes waterproof. This blinding action is aggravated in the case of the Cœur d'Alene mills by the presence in all classes of middlings of an unusual amount of finely divided particles of wood.

The objection to the V-tanks is that the dewatering is only partial and the stream from the plug is with difficulty spread evenly over the width of the roll faces. The effect of splashing water into rolls with the ore is to cause uneven distribution of the feed across the roll faces. Also in fine crushing the advantages of choke crushing are lost. Then, too, corrugation of the rolls, after being once started, increases very rapidly when water is introduced into the shells, for it follows the troughs, carrying the ore with it. In many of the mills the rolls run without the covers so as to render more easy the task of keeping them in eye. In such cases the grit splashing from the roll faces is extremely destructive to the bearings and largely accounts for the unsightly appearance which many of the rolls present. For dewatering fine material for rolls nothing is better in my estimation than mechanical rake or scoop dewatering devices, the overflow from them being led into conical tanks, the sludge formed from the settlement being introduced under the rolls for washing the faces and transporting the feed in the spouts below.

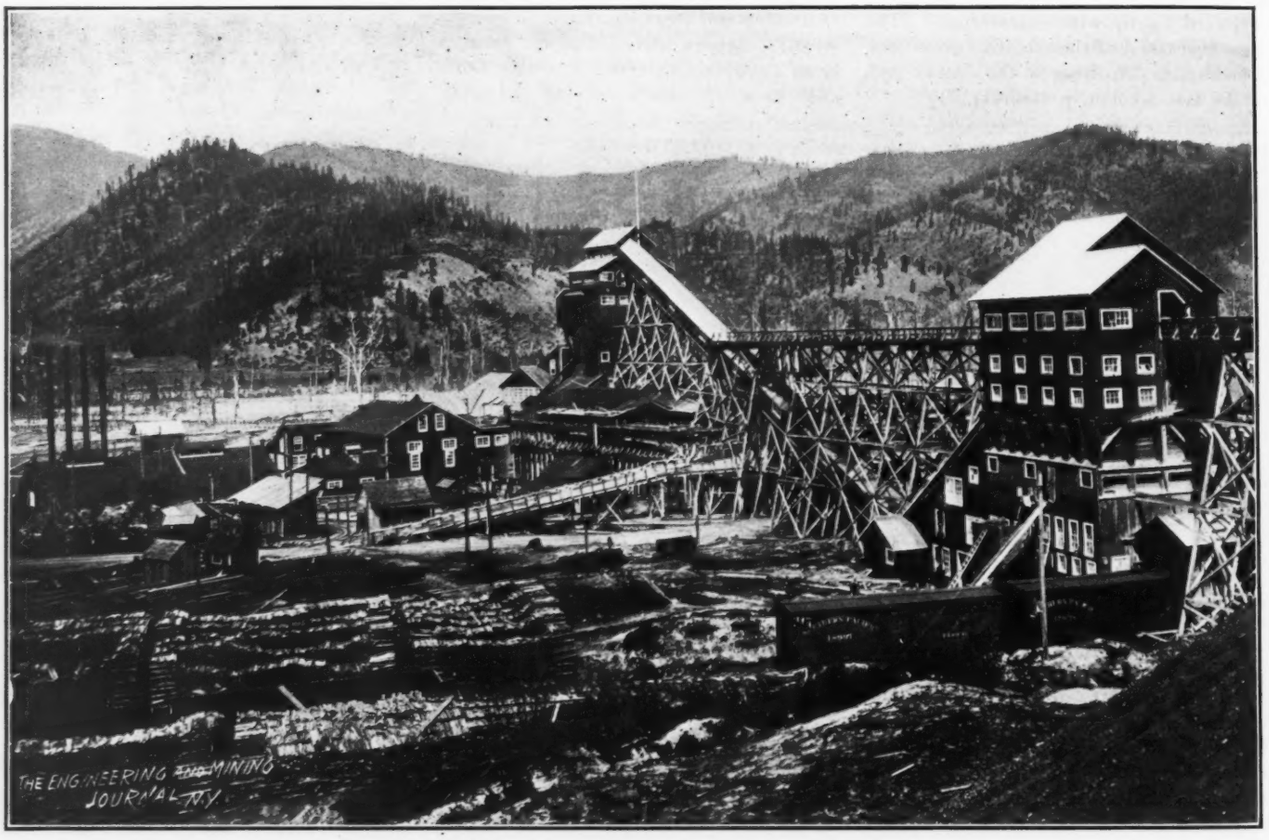

FIG. 9. BUNKER HILL AND SULLIVAN MILL. COEUR D' ALENE DISTRICT

Only Partial Choke Feeding Employed

The matter of employing only partial choke feeding in fine crushing might properly have been considered also under (1) as it results from failing to keep the nuts tight on the rolls and the roll faces heavily pressed against one another. If water is introduced into the rolls with the ore it is evident that the speed of entry is increased whether an inadequate dewatering device is introduced into the spout or not, as the sheet of ore in the water is thinner to compensate for its greater velocity, and grains cannot lie abreast of one another at the crushing points. Argall has shown that the percentage of finished product decreases as the set of the rolls and size of ore fed to them is diminished. By finished product he means that portion of the ore which is undersize and will not be returned to the rolls. He also shows that by employing choke feeding the percentage of finished product may be largely increased. In many of the mills there are middling circuits without a vent; that is, the middlings from a group of jigs pass to rolls and back to the trommel line from which they came. Under this condition it is impossible to prevent the rate of feed at the rolls from going up by leaps and bounds if loosely set. The practice of making periodical sizing tests of the middlings before it enters and after it leaves the rolls is to be commended.

Rolls Often Situated in Inaccessible Places

The situation of rolls in dark, wet and not readily accessible places is another handicap to their operation. If the location be disagreeable the men delegated to look after the rolls will avoid it as much as possible, to the detriment of the work

being performed by the machines. If the rolls be located in an inaccessible position, necessary repair work will be avoided as much as possible. In many of the mills the first two sets of rolls are mounted on pedestals or framed supports above the floor in order to make the boot of the elevator accessible from the floor level; this arrangement naturally increases the difficulties attending dismantling and assembling the rolls when shells are being changed. The dollies are mounted on wooden beams, the tracks being made of strips of sheet iron. As the tracks are parallel to the long axis of the roll frames the suspended shell and shaft can only be moved in a fore and aft direction, and such a crude device can usually be moved only by using a bar under the dolly wheels. In raising a shell much time is lost in tying slings of chain or heavy rope and securing chain blocks. Chains and ropes are very treacherous for this kind of work, the best device being loops made of carefully spliced wire rope. On account of spoutings, elevators, etc., much freedom of movement with carriers cannot be obtained. Under the usual prevailing conditions the changing of a set of shells occupies from four to eight hours. Under best conditions it should not occupy more time than two hours. And without exception, the shutdown of one set of rolls means the stoppage of the entire mill. The ability to keep his mill running long periods is regarded as a cardinal virtue in a foreman.

The ideal way of installing rolls is to place the whole battery side by side on the same foundation line. No spouting, shafting or belting should intervene between them and the roof, nor should any devices such as elevators be placed between them. The bottom of the frames of the rolls should be set even with the floor and the space assigned to the rolls flooded with light. Ample space should be provided around each roll and in front of them. The rolls should be driven entirely from one side by a countershaft located beneath or behind the roll floor. The single-belt drive on two pulleys of the same diameter located on the same side of the roll is the best. A track should run the whole length of the roll floor and lead into the repair shop. Over the rolls and spanning the whole width of the roll floor should be a light crane of the type whose movements are controlled by chains reaching the floor below. In some large establishments the extreme practice prevails of unbolting a set of rolls out of repair at the foundation, removing it by a crane and substituting another in perfect repair.

All the usual methods of reducing corrugations and removing flanges are practised. Well cared for shells never flange, and, receiving feed under 8 mm. in size, corrugate to an inappreciable degree. The best way to remove corrugations is to put the shells in a lathe without removing them from the cores or hearts. Despite the foregoing criticisms the roll practice of this district is no worse than in a large number of mills all over the continent.

Movable Pillow Block Rolls Generally Used

The usual pattern of roll to be seen consists of a low heavy-base frame, two rigid pillow blocks and two movable pillow blocks sliding on the frame, nests of springs and master bolts, etc. The "pin-pointed lever" style of roll is to be seen in a few mills in the district, the Allis Reliance roll being used at the Last Chance mill. This latter type of roll, though, is no longer the fashion. Argall has claimed that they tend to develop end thrust, an argument the truth of which I cannot see, providing the axes of the shafts are parallel in all positions of the movable roll; and it is not obvious to me why this type of roll should lose its parallelism more readily than any other. In regard to wear at the pin points my experience has been that where the rolls were not kept clean the pins and lever were very quickly worn to an alarming degree, in some cases to such an amount that the levers had a very perceptible sidewise wabble while crushing. On the other hand, where the rolls were housed and kept scrupulously clean no trouble of this kind manifested itself.

The very best work that I have secured with rolls crushing wet ore was with a battery of Reliance rolls. An improvement on the usual design would be to provide the lever pins with removable bushings. The greater number of parts in the lever style of rolls makes a greater risk of bolts and other parts becoming loose under vibration. Working under the best conditions, however, they are far less liable to chokeups, as they yield more readily to sudden increases in the rate of feed than do the movable-pillow style of roll. Some makers of the pillow-block roll provide removable slides in the pillow block to receive the wear, but none, so far as I know, for the frame. This is on the principle that moving parts exposed to wear or abrasion cut faster than stationary parts which receive pressure from them. Nevertheless the frame does become seriously worn in time.

When the rolls of this type are new the movable pillow blocks slide on the frame readily enough, but in time grit becomes lodged between the contact surfaces, cutting them and opposing free motion. Unless frequently cleaned the movement of the pillow blocks becomes sluggish. If there be lost motion from wear and opposition to motion from grit and worn contact surfaces the movable pillow blocks first tend, when beginning to crush, to rise up about the lower rear edge, after which they begin to slide. Under this condition sliding contact and wear are greatest at the rear ends of the blocks. At one of the mills I saw movable pillow blocks which, owing to greater wear at the lower rear ends, had a slope of an inch to the foot. The wear had proceeded to the extent that the nut of the master spring rod was resting on the frame of the rolls. I regard the wear of the slides and the sluggishness of the movable pillow-block type as serious faults, but do not see how they can be overcome.

In the lever style of rolls the pin joint is not in a position so exposed to grit and that style of joint could be made grit-proof. Argall's movable roll was mounted on a U-shaped piece which rested on friction rollers at either side. In wet crushing, if this device were adopted, trouble would probably ensue from the flattening of the rollers chafed by grit. The advocates of the rigid roll would probably say that the way out of these difficulties would be to rigidly fix the boxes. Without going into the merits of that type of machine it need only be said that with fine crushing, at least, the advantage to be obtained from choke crushing by spring rolls is too great to be lightly put aside.

Special Lever Roll Would Be Adaptable for Wet Crushing

Under the conditions which have been outlined as existing, the movable pillow-block style of roll, another name for which is the straight-line roll, is preferable to the lever type and is more generally liked by the millmen. The straight-line roll is simpler in its construction, more free from vibration and hence the loosening of nuts, etc., and more free from racking sidewise movements than the lever type as displayed in the Reliance roll. But with this roll or a similar one as a basis I believe that a roll could be designed for wet crushing which would be superior to it under all conditions of service. In such a design ample bearings should be provided at the pin joints and the levers should be rigidly joined together to secure the advantages derived by Argall from his U-support, the maintenance of parallelism of the roll faces.

In the matter of bearings I prefer a single-piece box, and for wet crushing a liner or bearing bushing of bronze. In wet crushing hot boxes seldom occur, the evaporation of water on the faces of the roll parts and the convection of heat by the water flowing through them keeping the bearings sufficiently cool. The main thing to guard against is grit and in assisting to do this a one-piece bearing is better than a two-piece and bronze is more resistant than babbitt. A bronze bushing not only lasts longer but is very quickly replaced by a new one when worn out. For alining and securing the shafts in position nothing is better or more simple than plain collars. The collars on the Reliance roll had a projecting edge which encircled the ends of the boxes; this was a very excellent guard against the entry of grit, for whether the collars shifted their position somewhat or not, a protective layer of grease supported by the collar was always maintained.

The No. 1 rolls are always equipped with cast-iron shells obtained from local foundries. They cost 4.5c. per lb., laid down at Wallace. Midvale or Latrobe rolled shells, which are used for the other sets, cost 7.5c. per lb. at Wallace. Worn-out cast shells are sold for $16 to $20 per ton when mixed with soft scrap, the higher price being paid when there is a large proportion of soft cast iron. Mixed iron and steel scrap sells for $5 per ton.

Maintaining Highways over a Caved Mine

At the Chapin mine, Iron Mountain, Mich., where the caving system of mining is employed at a depth of about 1200 to 1400 ft., the surface of the ground has caved, forming a pit nearly one-half mile long, 800 to 900 ft. wide, and 100 to 130 ft. deep. It is necessary to maintain a street crossing, a foot path, two railway tracks, the St. Paul and the Northwestern, one 12-in. air pipe and a 28-in. sewer pipe. This sewer pipe carries away the water pumped from the mine, in addition to the sewage of the city. Records for a number of years show that the sinking of the ground along the Chicago & Northwestern track was quite uniform, averaging 5/8 in. per day, or 19 ft. per year when the caving system was first employed. It is now less than 1/4 in. per day. This refers to the portion of the track shown in the accompanying photograph where the pipe and street crossing are maintained. No sudden movements of any importance have been noted.

The Chicago, Milwaukee & St. Paul railway was built into the city after the pit was formed, and it has been filling and lifting the track since 1898. This company only has an easement across the caved ground, and, of course, it has no claim against the mining company for damages. The St. Paul railway has a gravel train at work all the time to keep up the tracks over the mine.

The St. Paul crossing is at a place where the mine work is carried on more actively, and the settling is from 20 to 25 ft. per year, being much more than where the Northwestern track crosses. The fill is 128 ft. high, while the slope distance on the side is 225 ft. In keeping up the track flat cars, loaded by steam shovel, are used for hauling gravel. They are dumped by means of a plow which is drawn by the locomotive. The cars are placed in the desired position and the brakes set. The plow is connected with the engine by means of a 1¼-in. cable. All the dirt is delivered on one side of the car. Three tracks are kept up across the mine. The center one is the main line; the other two, one on either side, are usually from 3 to 5 ft. lower, and are simply used as a bench or shoulder from which to dump the dirt and thus maintain a wide embankment. As the track settles the ties are lifted on the outer track and the earth tamped underneath. When these are brought up to about the level of the main line, the work is then diverted and the main line lifted until it is in its true position. As the mine goes deeper and the ground settles, the base of the fill is ever widening and as a result the railroad gains but very little on the sinking.

The work of the Chicago & Northwestern railway is much simpler inasmuch as its right of way is near the street, as shown in the photograph, and the settling is less. This company has been maintaining its track here since 1897. The mining company, of course, has to keep up the street crossing, and in doing so maintains one side of the embankment for the Northwestern railway. The street crossing settles approximately 8 ft. per year, and this is kept up by a number of wagons filling in with all the waste dirt from the mine. The railroad brings in a few trainloads of earth intermittently as needed. In the fall, before winter sets in, additional wagons are put on to haul in sufficient material to bring the road up as nearly level as possible. The street, which is kept up as a public highway, is 50 ft. wide.

The pipe lines mentioned are side by side, being mounted upon pillars 20 ft. apart, and built of wooden blocks, as shown in the illustration. The pipes are on rollers to take care of the expansion and contraction. Between each of the large supports shown in the illustration there is a smaller one upon which a 2¾x24-in. jack-screw is mounted. As the entire line settles these jacks are given a few turns until the pipe is brought to a level position, and then it is wedged in place on the main pillars. After the jacks have been extended their full length they are taken down and the foundation for them is built up and the jacks replaced. In this way both water and air lines have been maintained for a number of years without any serious accident. On top of the pipes a framework has been constructed which forms a foot path across the mine.

FILL AT CHAPIN MINE SHOWING NORTHWESTERN TRACK, WATER PIPES, FOOT PATH AND STREET

Chromite in Canada

There has been little variation in the output of chromite in Canada during the last four years. According to the figures given by the Department of Mines, the total shipments in 1908 were returned as 7225 tons valued at $82,008, made up of 3472 tons of concentrates, valued at $45,300, and 3753 tons of crude ore valued at $36,708. The shipments in 1907 were 7196 tons, valued at $72,901. The production in 1906 was larger than for either one of these years, being given as 9035 tons, valued at $91,859. Figures giving the imports of chromite into the United States from Canada, however, show that more chromite was produced than is shown by the Canadian returns.

The chromite is mined in the Eastern townships of Quebec, chiefly in the township of Coleraine at Little Lake St. Francis and Black Lake, by the Dominion Chrome Company and the Black Lake Chrome and Asbestos Company, both operating under one management.

There have been many attempts to solve the secret of perpetual motion. The nearest approach to that ideal—though its inventor makes no claim to have discovered it—is a timepiece devised by the Hon. R. J. Strutt, Lord Rayleigh's son, which consists of two leaves of aluminum, an exhausted glass tube, and a fraction of a grain of radium. The radioactivity of the radium causes the aluminum leaves to move once a minute, and with a wireless coherer a bell rings at each movement. For 10,000 years at least the wonderful energy inherent in the microscopic piece of radium will, it is calculated, continue to act, and nothing whatever needs to be done to the clock once it is set going.

The Ruble Hydraulic Elevator*

By J. McD. Porter.†

In many of the old placer-mining districts are still to be found large tracts of gold-bearing gravel not suitable to be worked with a dredge, because the bed is too shallow or the gulch too narrow. Frequently there is not enough grade to handle the gravel successfully by ground sluicing or a bedrock flume, or it contains too many boulders to be worked successfully with the ordinary pipe or tube hydraulic elevator.

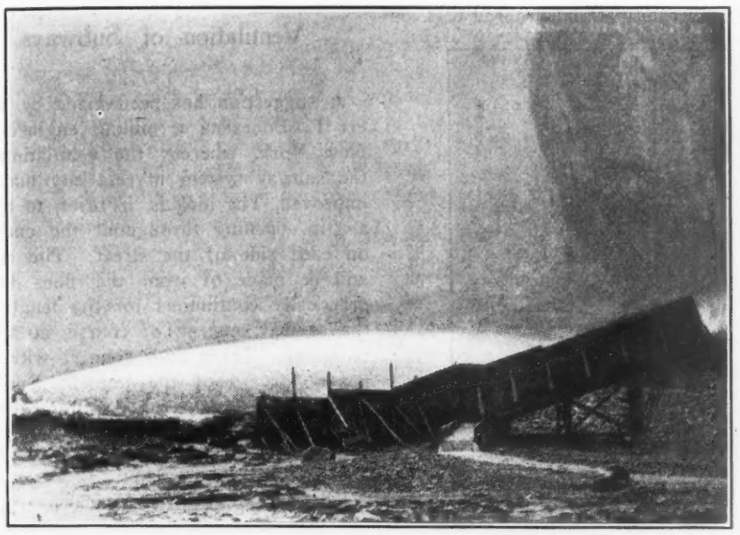

FIG. 1. THE RUBLE HYDRAULIC ELEVATOR AS OPERATED WITH ONE GIANT

In southwestern Oregon, two practical placer miners named Ruble, after working for years trying to make money out of placer ground containing many large boulders, invented and patented a hydraulic elevator of an entirely new type, and one that has been found to work very successfully in flat ground and in gravel containing many large boulders. It is an extremely simple contrivance.

A few years ago I acquired the property near Pierce City, Idaho, known as the American placer mine. Various attempts had been made to work this ground. A bed-rock flume had been installed by one company, an Evans elevator by another, and still other methods were tried on a smaller scale. All were unsuccessful. I installed a Ruble elevator, and it has proved very satisfactory. Working under 100-ft. (pipe) head, the ground has been handled at a cost of a little less than 8c. per cu.yd. The conditions at the American mine are exceptionally hard, the boulders being large, heavy and numerous. Basalt boulders, up to a size of 32 in., have been elevated to a hight of 16 or 17 ft., with a 4-in. nozzle stream, under 100-ft. head. Boulders larger than this size are blasted.

*Paper read before the Spokane meeting of the American Institute of Mining Engineers, September, 1909.

†Mining engineer, Spokane, Wash.

Operation of Giants in Connection with Elevators

At the American mine, a foreman, two pipemen, and two laborers are required per day of 24 hours to operate the elevator, which is the 25-ft. size, having 25 ft. of grizzly 8 ft. wide. This elevator handles from 280 to 300 cu.yd. per day. In ground containing fewer and smaller boulders the capacity would be much greater and the cost of operation much less per day and per yard. At first I used two pipemen on each shift, one driving the gravel to the elevator, the other elevating it, each using a No. 2 giant with 4-in. nozzle. Later, I changed to No. 3 giants, using 5.5-in. nozzles, which enabled me to use all the water in one stream, dispensed with one pipeman on each shift, and materially reduced the cost of operation. I also found that I could handle about 25 per cent. more yardage in this manner than by dividing the water into two streams. Fig. 1 shows the operation of the elevator with one giant, the sluice discharging in the foreground; Fig. 2, the operation with one giant.

The elevator is so constructed that it is impossible to choke it. The elevator giant, or the giant that elevates the gravel is placed in line with, and about 50 ft. from, the elevator, which leaves room for the field giant to pile up gravel in front of the elevator. The water is then shut off from the field giant, turned into the elevator giant, and the gravel run through the elevator. While this is being done, the field giant may be moved and reset, if necessary. In deep, undrainable ground, a water lift is attached to the side of the elevator, to carry off all the water after using. The foreman and laborers can reset the giant while the pipeman keeps the water continually at work. The sluice boxes may be cleaned up in about 2 hours, while the water is being used in the field giant. The laborers break up the large boulders, cut and burn brush, move and set the giants, help move the elevator, and make themselves generally useful.

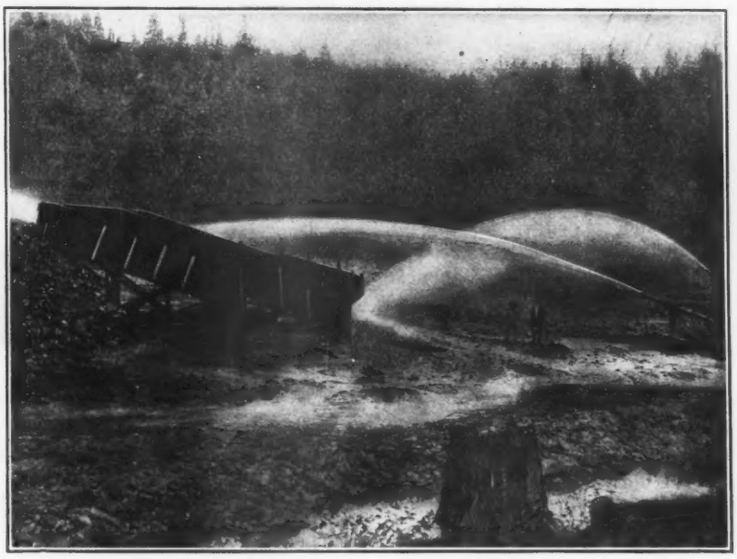

FIG. 2. THE RUBLE HYDRAULIC ELEVATOR WITH TWO GIANTS IN OPERATION

Construction of the Elevator

The Ruble elevator is a combination of grizzly, undercurrent, and elevator. It separates the fine gravel from the coarse rock and boulders while in transit up the elevator, and does it perfectly. The fine gravel, sand, and gold drop through the grizzly into an apartment underneath the grating floor, out of reach of the force of the hydraulic stream which is lifting the heavy rocks to the dump. The fine gravel, with its contents, is now acted upon by the water of the elevator giant, after it has lost its force, and with this water is delivered by means of an inclined, smooth floor under the grizzly to

the sluice, which is the gold-saving department of the elevator. The fine gravel and sand, after passing the sluice are delivered to a dump separate from the boulder dump. Operating with fine material only, the sluices are closely and finely riffled, and are much wider than the usual sluice used for coarse rock, thus furnishing a large gold-saving area in a short sluice.

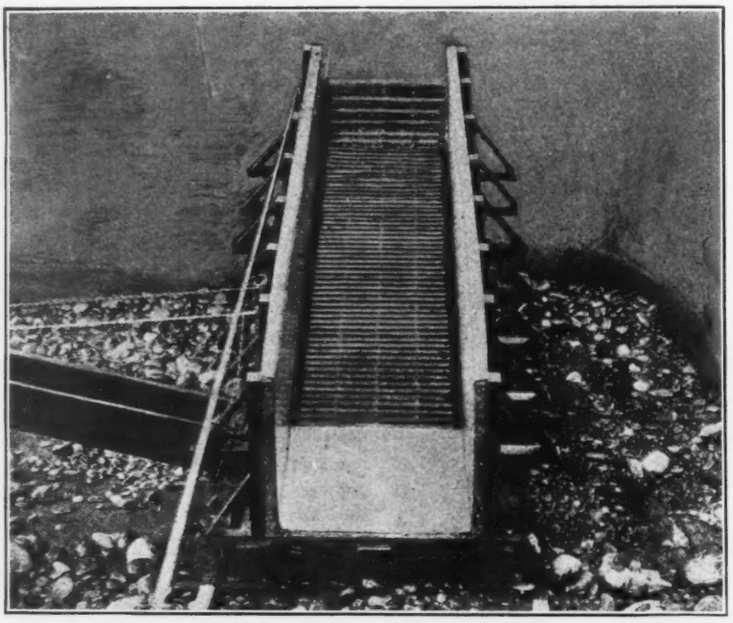

FIG. 3. GRIZZLY USED WITH THE RUBLE HYDRAULIC ELEVATOR

This appliance solves in an inexpensive and economical manner the difficult problems of inadequate dump, deep and undrainable ground, and the handling of heavy boulders and wash. It effects a close saving of gold and an economical use of water and time. Fig. 3 shows the interior appearance of the grizzly; also the sluice swung from its bearings with the apron of approach removed in order to move ahead.

The elevator rests on rollers, placed on skid poles on the bed rock, and is easily moved. When the gravel is washed from in front of the elevator and the space in the rear is filled with boulders and tailings, the bed rock is cleaned up, a horse is hitched to the elevator, and it is moved forward to a new position nearer the gravel bank, leaving room for a new boulder dump in the rear. When horses are not available, the elevator can be moved by hand with a capstan. At the American mine the elevator is moved three or four times each month. It requires from 1 to 1.5 days to move and reset it. The sluice boxes are usually cleaned up every second day. No time is lost in cleaning up, as the field giant is kept at work during that time.

Advantages of the Elevator

A few of the points of merit of this elevator are: (1) It handles larger rocks, with less water, than other types of elevators. (2) It dispenses with the boulder crew, either at the mine, ground sluice, sluice box or dump, except in rare cases. (3) It saves the gold, and the gold-saving department may be protected by lock and key. (4) The gravel is picked up in close proximity to the giants, the gold immediately extracted, and the boulders and other waste material dropped back on bed rock previously worked off, instead of being transported a long distance to the dump. It makes its own dump. Fig. 4 shows boulder dumps left by the elevator.

Strange as it may seem at first thought, it is easier to elevate the gravel than it is to drive it along the level bed rock, as is shown when the water is divided into two equal streams, the field giant being unable to keep the elevator giant supplied with gravel. In driving the gravel along on the bed rock, the water has more or less downward pressure, causing more friction, while on the approach and the grizzly, owing to the inclined construction, it is lifting the gravel and boulders, causing less friction or dragging.

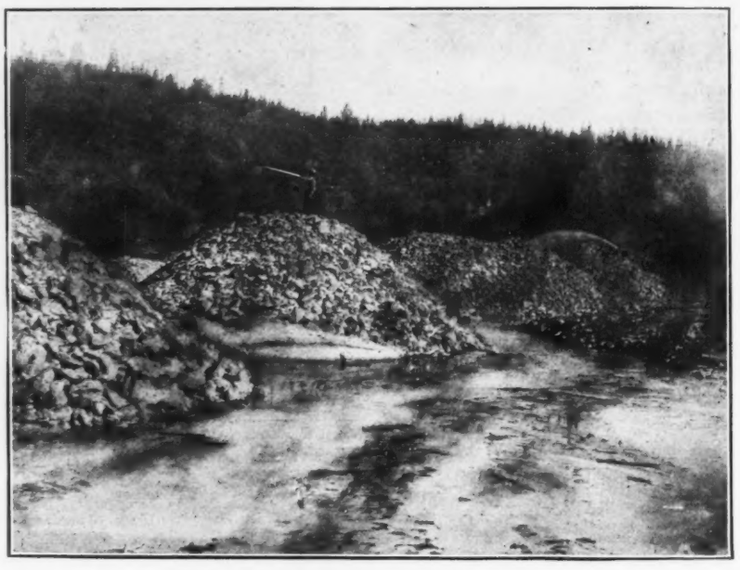

FIG. 4. BOULDER DUMPS LEFT BY RUBLE HYDRAULIC ELEVATOR

Ventilation of Subways

A suggestion has been made by Robert E. Booraem, a mining engineer of New York, whereby the ventilation of the subway system in that city may be improved. The idea is, in brief, to make a 5-in. opening throughout the curbing on each side of the street. The curbs will be made of iron, the flues being practically continuous for the length of the subway, except, of course, at street crossings. These flues connect with the upper corners of the tunnel. Surface water is caught in a suken gutter covered by grating.

In addition to the natural tendency of the heated subway air to rise, moving trains will push the foul air out ahead of them and suck in fresh air behind them automatically. Thus the escape of dust and foul air will be distributed evenly along the subway route, avoiding the unpleasantness to pedestrians caused by sudden puffs through the present sidewalk gratings.

Further, abundant ventilation and a little daylight will be afforded to the subway in case of accident causing the stoppage of trains; smoke from fires caused by short circuits can escape; and opportunity is given to flush out the subways occasionally by a hose from the surface.

The Uyuni district of Bolivia is exporting a good deal of argentiferous zinc ore.

The Magistral Copper District, Mexico

By P. A. Babb*

About 12 km. southwest of the town of Ameca, state of Jalisco, Mexico, and along the northern slopes of the range limiting to the south the rich and verdant Ameca valley, there is an interesting copper camp, the importance of which is but becoming appreciated. A quarter of a century and more ago this section was favored with some attention because of the shallow concentrations of native gold along the weathered outcrops which was easily removed with quicksilver in arrastras; but nothing of a formal nature developed from this work. Isolated patches would run from 6 to 20 grams per ton, but most of the outcrops would average nearer 2 grams, and at a few meters of depth the best ore would drop to this average. The camp was practically abandoned until a decade ago, when all but two of the present properties were free ground. Six years ago the present most important property was for sale at 2000 pesos, and today it has ore worth over $1,000,000 blocked out for smelting. Several properties denounced within the last six years are now under options for prices ranging from 25,000 to 125,000 pesos, though none are extensively developed.

Ameca is the terminal of a branch of the Mexican Central Railroad, and several American railroad men and prospectors made their headquarters there. The Magistral district was the nearest mineralized ground, and, as usual in such cases, everybody did "a bit of mining on the side." Several veins were denounced, and small crews of native miners started tunnels and prospect shafts. In this particular region the rains of the wet season are heavy and the result is that the denudation of the outcrops follows closely behind the advance of weathering in the veins; therefore, at a few meters of depth sulphides almost invariably appeared, often across widths of several meters between good walls. The experienced prospectors immediately realized that here was something that smacked of a real copper camp, and capital was approached for serious operations. The camp is now in that stage where the labor of the prospector is about to bear fruit; there is already one "mine" in operation, and several promising prospects are about to pass to incorporated concerns.

*Mining engineer, Ave. 5 de Mayo No. 32, Mexico, D. F.

Veins Form Crests of Ridges

In the state of Jalisco, the Central Plateau of Mexico juts out through the western Sierra Madre, beginning along the Rio de Santiago and south embracing all that section about Ameca, extending to the west nearly to the Mascota district. The ancient land surface, presumably of the characteristic cretaceous sedimentaries of the Central Plateau, is for the most part concealed by recent lava flows, and only occasionally are limestone strata disclosed. The Ameca river in its valley-forming processes has worn its way through the lava capping and the underlying and vein-bearing eruptives, and disclosed the limestone. The slopes left behind the advancing and deepening river bed have been subjected not only to the rains from the north, but also to the wear of the drainage from the lava mesas to the south. The result was the formation of deep and narrow arroyos along the upper slopes, widening into embryonic valleys with gentle slopes as the Ameca or main valley is entered. In the Magistral district the irregular degradation of the slopes has disclosed the veins which form the ridges due to their presenting more resistance to denudation than the country rock; while between them have formed the arroyos feeding into larger streams that cut across the veins and pass into the Ameca valley.

The veins form an east-west system, are fairly persistent along their strike and occur entirely within the eruptive rock. The particular rocks at Magistral seem to resemble more those of the western Sierra Madre than of the Central Plateau, and the thought comes easily to one that they may form sort of a connecting link between the sedimentaries of the latter and the igneous mass forming the former. The body of the eruptive is a greenish-colored hypersthene-andesite, but the most northerly vein is cut by a hornblende-granite and one of the veins to the south of the district forms altogether in this rock; all the others, however, thus far are limited to the andesite.

MAGISTRAL MINE, AMECA, JALISCO

SHAFT HOUSE, ZAPOTE MINE

Impoverishment Expected at Water Level

The veins, except where occasionally under remnants of the capping rock, outcrop strongly, and at properties such as Zapote and Magistral, where there is relatively little vegetation, present a splendid surface showing. The veins are fault-fissures; the principal or east-west veins are, so to speak, master-faults, while certain cross veins which branch from the east-west veins are perhaps from readjustment of local strains along weakened lines. The general dip of the principal veins is to the south. The walls as a rule are well defined and accompanied by a talcy selvage. The gangue is the country rock itself; sometimes almost unaltered rock, again little-altered breccia, cemented by silica, or perhaps the entire rock altered and replaced by amorphorus forms of silica. Interesting fracture zones are in places encountered, clearly showing their cause to have been from increase in bulk due to the altera-

tion of hornblende or hypersthene to chloritic minerals.

The ore is chalcopyrite, clean above the water level, but accompanied by iron sulphides as depth is reached. It is strongly suggested that an impoverishment in the copper may be found as the workings eventually pass below the water level. An ounce of silver is ever present, and one or two grams of gold. The gangue is made up of silica, and silicates yielding about 1 per cent. lime, 2 to 3 per cent. iron and about 6 per cent. alumina.

Well defined oreshoots make up the workable bodies, varying in width from 2 to 15 m. of ore between good walls, while the length will average perhaps in the neighborhood of 60 m., although over 100 m. occur in several cases. There is a sort of compensation in the narrower veins in that the shoots are frequent and near together, while the rather limited work done in the larger bodies indicates that in these the shoots are much farther apart.

District Only Partly Developed

The only mine of the district is the Magistral, in which may be seen several splendid bodies of sulphide ore. This property claims, and it appears reasonable, to have over $1,000,000 in sight. The mine is being handled by experienced men and properly opened up. But a small part of the property has been explored.

The Magistral mine, operated by an American company, is ready for its reduction plant, and the management is now placing orders for a 150-ton reverberatory furnace, meanwhile conducting experiments to determine the equipment of a concentrating mill.

The Zapote, Almoloya and Los Timones are partly developed properties of considerable promise, and sufficiently developed to guarantee a future. The former is under option to American interests, the second to Mexico City operators and the third is being incorporated in the United States in preparation for working *en forma*. Other prospects with good ore, but in earlier stages of development, are the Cerritos, Ocotes, Palo Alto and Vetas Grandes.

The general grade of ore will not support shipment in its crude form to the custom-smelting centers nor in many cases to a smeltery erected in the immediate section, and concentration will be necessary before marketing. Fortunately, most of the ores thus far developed are amenable to this treatment. Water for concentration mills is not in abundance, but by reclaiming in settling tanks it is likely that no real obstacle will arise here. In the camp are many elements for cheap operating costs. Fuel and timber for the mines and construction is abundant in the ranges. Labor is plentiful and commands low wages. No burdensome amount of water has yet been met in any of the properties. The ground is heavy and in main levels requires substantial timbering; on the other hand, timber is very cheap. The ore occurs in well defined shoots, can be mined in large tonnages and without sorting. The camp is today in its infancy, only a small proportion of the probable productive ground being under development.

Dredging in California

Special Correspondence

Notwithstanding the activities of the Anti-Débris Association against the California dredge-mining industry, it is not making so much headway in prejudicing the people against the dredges as its friends hoped. It may be recalled that some months since an anti-dredge convention was called at Sacramento, where it was expected that resolutions condemning gold dredging would be adopted on general principles. But it turned out that some people in that region thought the dredging was doing more good than harm. At any rate, a committee was appointed to look up the whole matter and report, not to the convention which appointed the committee, but to the California Débris Commission and the Anti-Debris Association.

After a somewhat exhaustive examination of the conditions existing on the American, Feather and Yuba rivers, at the mouths of which most of the dredging is being done, the committee has reported that no damage whatever is being done on the American and Yuba rivers. Several very large dredges are operating on the American river in the vicinity of Folsom and also on the Yuba about Marysville. On the American it is found that no damage whatever is being done. On the Yuba the dredgers are commended for their work because they not only keep the river in its course, but use the tailings as embankments for the impounding of old débris from former hydraulic-mining operations. Regarding conditions along the Feather river, which includes the Oroville dredging fields, the committee contends that some harm is being done and that the water level is being raised. This is due, however, to the operations of a few of the many dredging machines in that locality, most of them doing their work at such a distance from the river proper that no harm can possibly result. These few dredging companies can be readily brought to see that they are doing damage to the industry in which they are engaged, and it is "up to" the other dredging companies to make them conform to popular opinion on the subject. Otherwise they will perhaps be severely dealt with by the Anti-Débris Association.

It is quite gratifying for the people of California to know on the authority of such a committee as that referred to, that gold dredging may be carried on in important sections without any damage whatever being done to rivers or adjacent lands.

New Operation

The San Joaquin Power and Gold Mining Company has been organized at Fresno to work the channel of the San Joaquin river near Millerton between Fresno and Madera counties. It is proposed to tunnel a mountain above Millerton for 1½ miles and change the river course so as to bare the river bed for six miles around the mountain along the Horseshoe bend. J. G. Anderson, of Fresno, is the prime mover in the enterprise. About 27,000 ft. of river bed have been located in the Horseshoe bend and covering the river channel.

Two dredging companies are engaged in prospecting ground along the Merced river near Snelling, Merced county. The Yosemite Gold Dredging Company has two drilling outfits at work on the Dale ranch, and the Oro Light and Power Company has two at work between Merced Falls and Snelling. These companies have taken bonds on several ranches near the river and intend thoroughly prospecting them. Meantime the dredge of the Yosemite company continues steadily at work.

Tellurium

No use has yet been discovered for tellurium. It is classed as a metalloid and is supplied as a chemical curiosity in the form of a black powder and as a metallic-looking substance with a fine columnar crystal form, in color somewhat resembling tin. Some of the compounds of tellurium have an offensive, all-pervading, and ineradicable odor. Chemists who have been experimenting with tellurium say, according to the U. S. Geological Survey, that after three months' exposure to sun, wind and rain, the clothing worn by them while they were making these experiments, although it had not come into contact with the tellurium compound, was still so unpleasantly scented that it had to be destroyed.

Since the Mexican Southern has acquired the railroad to Taviche, Oaxaca, and is pushing the grading steadily toward that camp, it is evident that all ore shipments from Taviche and from mines between Taviche and Ocotlan will soon be carried over the new road. The Oaxaca á Ejutla Railway will, therefore, have to find some other freight or show a decreased tonnage. A concession for a railroad from Ejutla to the Pacific has been secured by C. A. Hamilton and associates who may use a route already surveyed.

The Care of Small Steam Boilers

What Should Be Done to Render Them Safe and Keep Them in Condition; Some of the Dangers Caused by Incompetency and Neglect

BY WARREN O. ROGERS

The most common kind of small boiler is known as the vertical fire-tube, and is built in two types, as shown in Figs. 1 and 2. It is practically a locomotive boiler set on end, and consists of a shell in which is placed an internal firebox. It also has two heads, into which are expanded the tubes through which the hot gases pass from the fire to the stack. As the furnace plates and tubes are entirely surrounded by water they cannot burn if kept free from mud and scale and a proper water level maintained. Fig. 1 shows what is termed a through- or dry-tube boiler; Fig. 2 illustrates a submerged type, which is preferable to the dry-tube design as there is less trouble from overheated top tube sheet and tube ends.

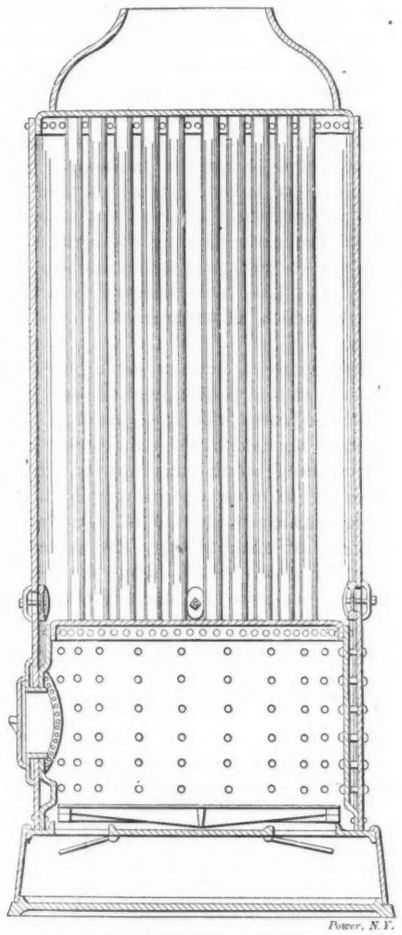

FIG. 1. A COMMON TYPE OF UPRIGHT BOILER

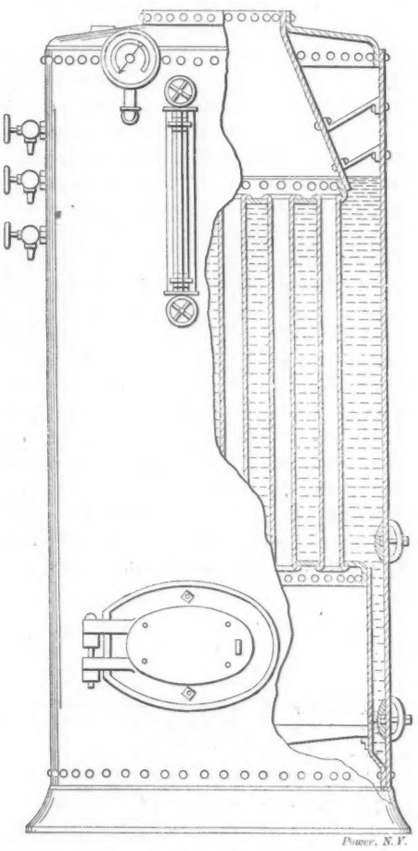

FIG. 2. SUBMERGED TYPE OF VERTICAL BOILER

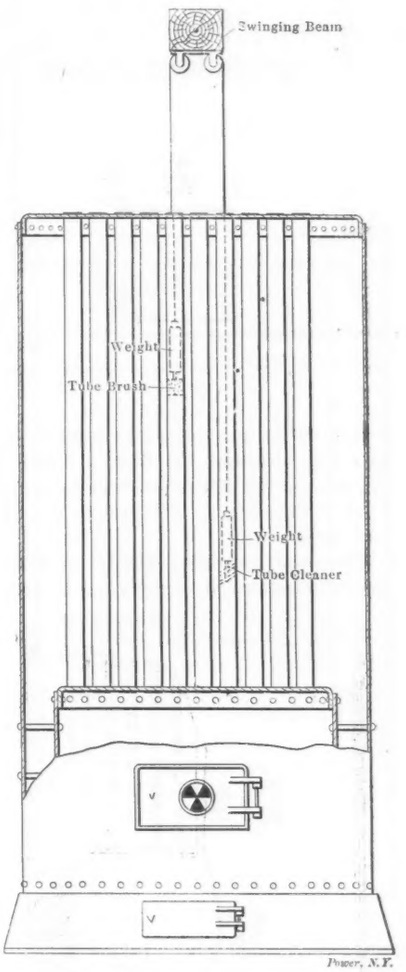

FIG. 3. METHOD OF CLEANING TUBES

These boilers are suitable for use where floor space is restricted, for hoisting work, excavations and wherever a small amount of steam power is required. They are also a favorite, owing to their low first cost and simplicity of installation; being easily moved from place to place they are greatly used on construction work of various kinds. Such a boiler is not economical, however, in the use of fuel, because the hot gases have a short passage through the tubes, and also because there is a lack of good circulation of the water within the boiler, while the outside surface is exposed to the cooling effect of the air.

By noting the construction of the boiler illustrated in Fig. 2, it will be evident that the matter of water level is important in order to keep the upper tube end protected from the flame. Low water is a common fault with the hoisting engineer, because his attention is concentrated on the management of the engine in hoisting and lowering its load and, becoming absorbed in the hoisting work, the boiler end is neglected.

In one instance recently, while passing an upright hoisting boiler, I failed to find any water showing in the water glass, although there was a good fire on the grate and a steam pressure of 80 lb. shown by the steam gage. In another instance the water level just showed at the bottom of the gage glass as it rose and fell in the act of ebullition. When the engineer's attention was called to the state of the water level he said he had "neglected it a little." Not only should the water show at the proper level, the second gage, but it should also be checked by means of the gage cocks by occasionally blowing them out during the day. This is something that is almost universally neglected in all types of boiler.

One fault in boiler operation, altogether too common, is that of forcing a new fire in order to get up steam in a hurry. The results of such a procedure,

NOTE—Reprinted from *Power*, Nov. 16, 1909.

on a vertical boiler of the type shown in Fig. 1, is to cause a greater expansion of the inner portion of the boiler over that of the outer shell, which causes leakage of the tubes in the crown sheet. When this occurs the leakage soon forms a deposit on the interior of the tube

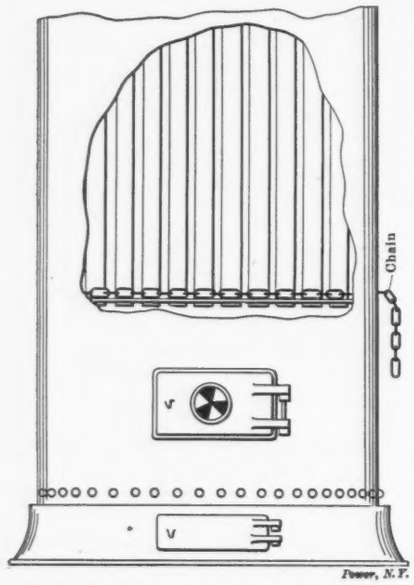

FIG. 4. CHAIN USED FOR REMOVING LOOSE SCALE

which not only reduces the heating surface but obstructs the draft. Naturally the ashpit must not be allowed to become filled with ashes, as the grate will warp and burn.

The steam gage also requires particular attention because it is subjected to abuse,

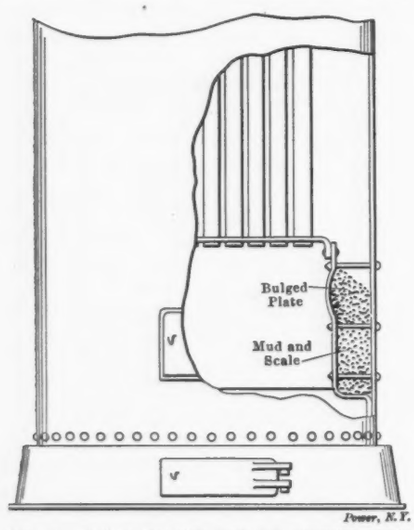

FIG. 5. PLATE BULGED DUE TO OVERHEATING

and the glass face soon becomes broken. When this happens the pointer or hand easily becomes bent and may thus register a false pressure. If the safety valve happens to stick the pressure becomes excessive, which is doubtless the cause of many explosions of this type of boiler. If a hoisting boiler is blown down once a day it is most fortunate. Once a week would probably be more like the actual practice. As the feed water comes from almost any source it is evident that the blowing down at stated intervals is essential in order to clean out the mud and loose scale. At least once a day is absolutely necessary.

Another matter that should have the engineer's attention is that of the fusible plug. It should be examined at least every three months, and in cases of bad water, where scale is liable to accumulate rapidly, the plug should be examined every time the boiler is cooled down for cleaning, as scale is liable to form over the fusible metal and prevent the steam pressure from bursting through the scale after the heat has melted the fusible metal in the plug in case low water does occur. There is more danger from this occurring where the plug is placed in the crown sheet than when placed in any of the tubes, as is sometimes the case.

Owing to the fact that the pressure in the vertical boiler tends to force the inner and outer cylinders apart, staybolts are used to prevent such a happening. The method of placing these staybolts is shown in Fig. 1. These staybolts are usually placed 4 in. center to center and, therefore, each staybolt will withstand the pressure of a surface 4 in. square.

In upright boilers handholes are provided, there being three or four on a level with the crown sheet, or lower tube sheet, depending on the size of the boiler. There will also be one or more at the bottom of the mud space. These handholes are for the purpose of cleaning out scale and mud, and should be removed each time the boiler is cooled down for washing out. It is not sufficient to open the blowoff valve and allow the water to run out and then fill up the boiler and get up steam again. When cleaning a boiler all openings should be accessible, and suitable tools used to remove the scale from the crown sheet, such as a hose and nozzle, chain and tube cleaner.

If the boiler is placed in a temporary position a convenient method of cleaning the tubes can be arranged as shown in Fig. 3. This consists of a swinging crane or bracket having suitable pulleys attached, over which runs a rope to which weights are supported. To one weight a tube cleaner is attached and to the other a tube brush. As the tube cleaner is forced down through the tube, due to the weight, the other weight is drawn up, the brush sweeping the tube clean. This device is a labor-saver and can be arranged to operate with almost any type of vertical boiler, regardless of size.

The use of a chain for removing scale is shown in Fig. 4. A stiff wire, say a piece of telephone wire, is inserted through one of the handholes on a level with the crown sheet, and out either through the same hole or one next to it. The wire is attached to the chain and the chain is then pulled through the handhole and around out through the other opening. Then water is turned on through the hose and the chain worked back and forth, thus assisting the loose scale out of the handhole. Precaution should also be used in thoroughly washing out the lower parts of the boiler, as an accumulation of mud or scale will cause the plate forming the walls of the firebox to burn and bulge, as shown in Fig. 5. This will necessitate a large patch, which is undesirable, or a new plate.

Frequently a new or dirty boiler will prime, and a badly proportioned boiler will also cause the same trouble. This is most noticeable when the boiler is being worked up to full capacity. In the case of foaming or priming in a new boiler, which is due to oil used in the process of manufacture, the remedy is to blow down often, avoid forcing the boiler, use care in opening the throttle and keep the water level at the proper hight. Opening the fire doors for a few moments and closing the throttle will relieve a case of foaming, but will not remove the trouble.

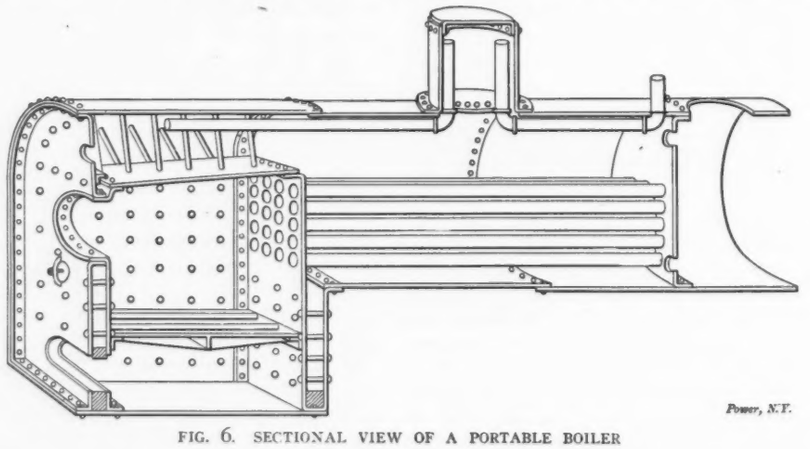

FIG. 6. SECTIONAL VIEW OF A PORTABLE BOILER

In Fig. 6 is shown a type of boiler frequently found where a portable steam generator is required. It is of the locomotive type and is usually mounted on wheels or skids. In this boiler the method of staying the front flat surface is

shown, and it is at once evident that more precaution against low water should be taken than in the case of the upright boiler, as the crown sheet is directly over the hot fire on the grate, and covered at best with only a few inches of water. It is also evident that scale and mud are to be avoided. If not, the crown sheet will become burnt and when the plate

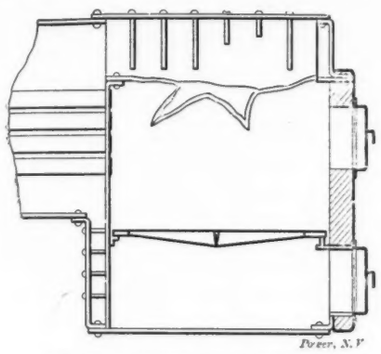

FIG. 7. FAILURE OF CROWN SHEET

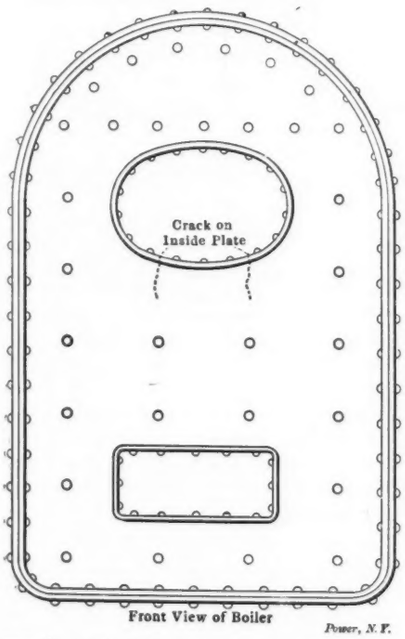

FIG. 8. SHOWING CRACKS ON INSIDE PLATE

has become weakened enough, the staybolts will pull out and an explosion occur with a result similar to that shown in Fig. 7, if no worse accident happens. Mud and scale should be washed out of the waterleg and the boiler thoroughly cleaned at stated intervals, depending on the condition of the water used.

The greatest trouble found with most upright and portable locomotive types of boiler is due to lack of care. Usually they are in charge of men who have no engineer's license and when the day's work is done, the fire is banked and the engineer forgets all about his boiler until it is time to get up steam in the morning. Naturally, the boiler does not get the attention in the matter of cleaning that it should, hence many are operated in a dangerous condition.

The old adage that a leaky boiler will not explode is strongly believed in if actual conditions as found are a criterion, especially where excavation work is being carried on. Numerous instances of leaky plates, joints, staybolts and rivets were seen on a recent visit to works where these two types of boiler were employed for hoisting purposes and supplying steam to drills, pumps, etc. In one instance the mud sheet was cracked on both sides of the fire door, as shown in Fig. 8, and a small-sized Niagara was streaming down the front of the boiler. In another case the same defect had developed and a repair had been tried by calking copper into the crack, but this questionable job did not hold and consequently the boiler was put out of commission.

How many of these boilers are operated day after day under such conditions is a query, but it would seem that a kind providence watches over men who unhesitatingly jeopardize their lives with unsafe boilers.

American Blast Furnace Progress

Referring to some recent records of blast-furnace production—including one of 918 tons of bessemer pig in one day by Edgar Thomson K furnace—James M. Swank says, in the *Bulletin* of the American Iron and Steel Association, that 32 years ago, in 1877, it was said boastfully in one of the publications of the association that "as late as 1850 the furnace that would make 50 tons of pig iron a week with any kind of fuel was doing good work; now there are many furnaces in Pennsylvania that make that much iron in a day, while a few make 75 tons a day as a regular product, and two—Isabella and Lucy furnaces at Pittsburg—have made over 100 tons a day for a week at a time." But the interest of our readers will be increased when they read what follows:

In 1881, four years after the above statement of good work by Pennsylvania furnaces was written, our report of the production of iron and steel in the United States in the census year 1880 appeared. In its pages, in a chapter devoted to some notable achievements of our iron and steel works, we gave the following details of the best work of our coke furnaces that had been recorded up to that time. These details indicate steady progress in blast-furnace practice from 1875 to 1881.

Isabella Furnace No. 1, at Etna, Penn., 75x18 ft., made 702 gross tons of pig iron in one week in 1875. Isabella Furnace No. 2, 75x20 ft., made 770 tons in one week in November, 1875; its best day's work in the same week was 116 tons. In one month in 1875 it made 3163 tons. No. 1, which had been widened to 20 ft., made 1130 tons in one week in 1881.

Centennial Furnace of the Cambria Iron Company, at Johnstown, 75x20 ft., made 578 tons of pig iron in one week in May, 1877.

No. 2 furnace of the Pennsylvania Steel Company, at Steelton, Penn., 75x20 ft., on fuel consisting of one-third anthracite and two-thirds coke, made 2916 gross tons of pig iron in November, 1878, 725 tons in one week, and 107 tons in one day.

In the week ending March 28, 1879, Lucy Furnace No. 1, at Pittsburg, 75x20 ft., made 857 gross tons of pig iron; in the seven days ending March 31, 1879, it made 945 tons; in the month of March it made 3684 tons, a daily average of 118 tons. On November 21, 1880, it made 202 tons in 24 hours.

One of Laughlin & Company's Eliza furnaces, at Pittsburg, 61x16 ft., made in one day in 1880, 130 gross tons of pig iron; in two consecutive days it made 253 tons.

On March 28, 1880, Furnace A of the Edgar Thomson Steel Company, 65x13 ft., made 113 gross tons of pig iron, with a consumption of 1965 lb. of coke per ton and with ores yielding 54.02 per cent. Furnace B, 80x20 ft., made 208 tons of pig iron on Nov. 22, 1880. Furnace C, 80x20 ft., made 224 tons of pig iron on April 28, 1881, the fuel consumption being at the rate of a ton of coke to a ton of pig iron. The best week's work of Furnace C in 1881 was 1357 tons and the best month's work was 5598 tons.

Neshannock Furnace, at New Castle, Penn., 60x16 ft., made 679 gross tons of pig iron in one week in December, 1881, its daily product being 82, 83, 91, 97, 104, 108, and 114 tons.

The furnace of the Low Moor Iron Company, at Low Moor, Va., 75x18 ft., made 110 tons of pig iron on Oct. 8, 1881, each ton weighing 2300 lb.; 703 tons in the week ending Oct. 8, 1881, and 2563 tons in September, 1881. The fuel used was coke made from New River coal.

Riverside Furnace of the Riverside Iron Works, at Wheeling, W. Va., 75x16½ ft., made 829 gross tons of pig iron in the week ending Nov. 6, 1881. The daily record was as follows, omitting fractions: 113, 115, 113, 121, 121, 121, and 122 tons.

No. 1 furnace of the Joliet Steel Company, at Joliet, Ill., 72x20 ft., made 126 gross tons of pig iron in one day in 1881; 788 tons in the week ending April 8, 1881, and 3276 tons in the month of April, 1881.

From the facts that have been presented it would appear that the first furnace in this country to make 100 tons of pig iron in a day was one of the Isabella furnaces, which feat was accomplished in 1875, as shown above.

United States Consul Will. L. Lowrie reports that radium has been discovered by Dr. J. Knett, mineralogist of the Austrian government for the Carlsbad district, in the Carlsbad thermal springs. It is claimed by some specialists that the curative properties of the Bohemian thermal springs are due in a measure to the radioactivity of the water.

Design of Bits for Power Drills

By Edward K. Judd*

In the Journal of June 12, 1909, appeared the translation of a paper presented by de Gennes before the Société de l'Industrie Minérale on the selection and use of bits for power drills. That part of the paper which treats of the method of using bits and advocates a higher degree of intelligence in the sharpening and tempering of drills is exceedingly well grounded, and it is, perhaps, true that American mining men have been remiss in that phase of the question. Assuming that the translator has correctly interpreted the remarks made, however, several points appear on which American practice differs so radically from that attributed to French practice as to afford an excuse for the following remarks:

The three points that seem to invite discussion are stated by M. de Gennes substantially as follows: (1) The bit having a concave cutting edge (Fig. 3) is the one most commonly used. (2) With a convex edge, the corners have less work to do and the center of the bit gets most of the wear; this feature is still more pronounced in the case of a pointed bit. (3) While working in hard rock, a bit having acute edges can be used, at full stroke, without choking the hole with cuttings; to avoid this difficulty while working in a soft rock, a bit with obtuse cutting edges should be used.

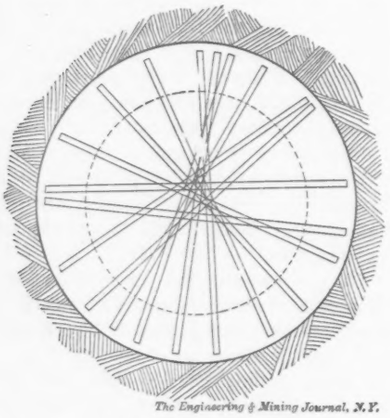

FIG. 1. IMPACTS OF CHISEL-EDGED BIT

American practice seems to condemn the concave edge as a source of weakness and confines bits of this type to service in coal or very soft rock only, such as shale. To cite examples, the edges of bits employed with coal undercutters of the puncher class have a pronounced concavity, and the cutting edges of jumper drills as used in coal and very soft rock are also concave. From every point of view it is apparent that the corners of a bit with a concave edge must do the larger part of the work of drilling, and in this shape the corners are the very parts that are least fitted to stand this; in a highly tempered drill they would be apt to crack off, and in a drill of softer temper they would quickly become blunt. M. de Gennes is quite right in attributing the more rapid wear on the corners of such a bit to the fact that the rock at the center of the hole is weakened by the impact of the corners, leaving less work to be performed by the center of the bit.

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Convexity to Take Wear from Corners

When speaking of the convex-edged bit, however, his statement that the wear is concentrated at the center for the reason that the rock will not be weakened by advancing corners, but will be solid clear to the center of the hole, does not seem to be supported by either theory or observation. To arrive at the theoretical considerations in favor of giving drill bits a convex rather than a straight or a concave edge, let us suppose a straight, chisel-edged bit to be working in the bottom of a hole. As the drill is turned, it does not revolve on its geometrical axis, since the hole will, of course, be somewhat larger than the long dimension of the edge of the bit. The marks made by the successive impacts of the drill will, therefore, cross one another eccentrically, as illustrated in Fig. 1, in which, it might be explained, the area of the inner, dotted, circle is only one-third the area of the hole.

The rock at the center is, therefore, weakened much more, per impact, than the rock at the margin, since the blows are distributed over a wider area toward the perimeter. The corners of the drill thereby get most of the wear. Furthermore, in hand drilling, and to some extent also in machine drilling, the bit rarely lies accurately in the axis of the hole when the blow is delivered. The difference between the diameters of the bit shank and of the hole is sufficient to permit the bit to stand at a considerable inclination with respect to the axis of the hole, as in Fig. 2. In this position, if the edge of the bit were concave or even straight the corner or angle on the side toward which the bit is inclined would receive nearly the entire force of the blow, blunting it if the temper were soft and probably breaking it if the temper were hard.

Whether or not this theoretical reasoning is correct, the truth of the fact just stated, that the corners of a bit get more wear than the center, can be substantiated by a few moments inspection of the dull drills delivered to any mining blacksmith to be sharpened. What is true of the chisel-edged bit which has been the subject of discussion up to this point would seem to hold for a cross or star bit having straight edges. To equalize the work performed by a bit, therefore, nothing is easier than to throw a little added burden upon the central portion by making the edge convex (Fig. 4) so that its center will work in advance of the corners and thus loosen the rock somewhat for the latter. If this convexity be carried to excess, making a pointed bit, it is quite possible that the center might then have to do more than its share of the work, as explained by M. de Gennes on the ground that fragments break away successively from the periphery of the hole, leaving the point to perform all of the work for the next few blows. It is a part of the blacksmith's art, therefore, to adjust the curvature of the cutting edge so as to equalize the wear for rock of given character.

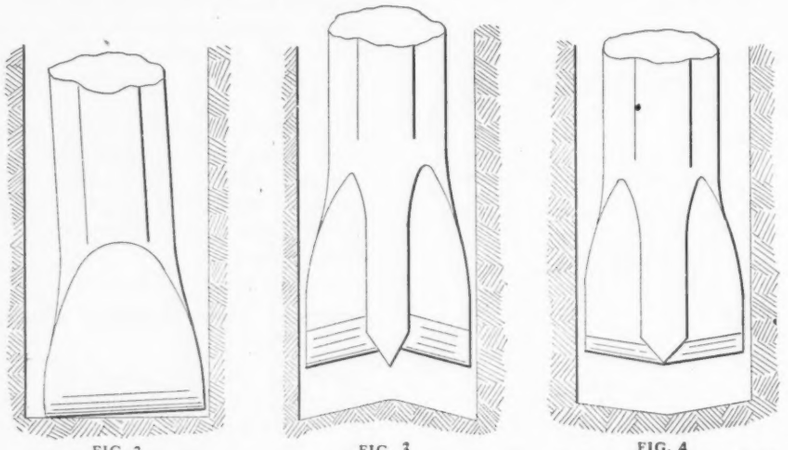

FIG. 2 FIG. 3 FIG. 4

CHISEL, CONCAVE AND CONVEX BITS

Pulverizing Action in Hard Rock

In discussing the sharpness, or acuteness, of the cutting edge, M. de Gennes attaches most importance to the relative amounts of the cuttings produced by an acute and by an obtuse edge, his idea being that an acute edge, working in a soft rock, will yield more voluminous cuttings than can be discharged readily by the churning action of the drill. In American practice this consideration is altogether subordinate, the main effort being to adjust the acuteness of the cutting edge and its tempering to accord with the hardness of the rock. The drill is not expected to perform the functions of a sand pump and

the excessive volume of cuttings from a soft rock are given extra space through which to escape past the point by reducing the thickness and the length of the wings of the bit. The result of driving a bit with acute edges at full stroke against a hard rock would be disastrous; if the steel were tempered hard enough to withstand the blunting effect, it would, in all probability, wear away by fracture.

It is useless to require a drill to do any actual cutting in a very hard rock; the action resembles more closely a pulverizing, as in a mortar, and for this purpose an obtuse angle is not only more efficient, but it also allows the bit to be formed in a more stocky, substantial manner.

The temper of a drill for use in a dense rock should be only of moderate hardness, so as to obviate splintering of the steel. For a soft rock the edge should be sharper, so that it can actually cut the rock, and its temper may be hard if desired. By then making the wings thin, more space may be left for the escape of the cuttings without detracting unduly from the required strength of the bit. In the absence of any accurate experimental data on the subject, the foregoing more or less theoretical remarks are presented in the hope that others may be tempted to bring forward any practical observations at their command.

Consolidated Goldfields Report

SPECIAL CORRESPONDENCE

The annual report of the Consolidated Goldfields of South Africa, Ltd., contains a survey of the condition and prospects of the mining industry of the Transvaal. The opinions expressed carry weight because they represent the views of those who have a large stake in the country and who have at their command expert advisers, political, commercial and financial, to report on every subject that affects the mining industry.

As a general survey of the mining situation in South Africa the report deserves great praise, but as a business statement of the company's affairs, it must receive unfavorable criticism.

The report embraces four separate reports: the report of the directors, summarizing the financial position of the company and describing the policy that is being pursued; a report by the joint managers in Johannesburg containing a large amount of statistical matter of general interest as well as information as to new legislation passed or proposed that has a bearing on the mines; a report by the superintending engineer dealing more especially with the working results and prospects of the company's mining interests; and a report by the consulting engineer in Rhodesia as to the interests of the company in that country.

NATIVE LABOR SUPPLY

With regard to the directors' report, the paragraphs which attract most attention are those dealing with the native-labor supply, because during the last few months a shortage has been experienced, due partly to the repatriation of the Chinese and partly to a decrease in the number of natives recruited. The report says that the existing supply is inadequate to the increased demand caused by the expansion of the mining industry and states that special efforts are being made to remedy the deficiency. The hope is also expressed that the Act of Union which will come into force next year will facilitate a satisfactory solution of the unskilled-labor question by insuring uniformity of policy. While a warning note is sounded as regards labor, it is satisfactory to find that no serious crisis is anticipated in the near future by the officials of the company, an opinion which agrees with the views recently expressed by the Prime Minister, General Botha, who, on sailing for South Africa, said that he did not view the labor question with the least apprehension, and expressed the opinion that the supplies of native labor in South Africa were by no means exhausted. In this connection attention may be drawn to the satisfactory manner in which the shortage of labor is being met by increased efficiency in the natives. On the Simmer & Jack mine, for example, the average number of natives employed during the last financial year was 12 per cent. less than were employed during the previous year, although the tonnage milled was increased by about 6 per cent. These results are encouraging and must help to allay the fears of those who anticipate a labor famine.

AMORTIZATION

Another important matter, of interest to all South African mine shareholders, and referred to in the directors' report, is the question of redeeming capital. Although mines are wasting assets it is not customary for the individual mines to make provision in their accounts for the redemption of property account. Shareholders are supposed to create their own sinking funds out of the dividends that they receive. The directors of the Goldfields propose to meet this point by appropriating a certain sum out of profits for writing down the value of their investments in the crushing mines. This year the sum of £500,000 is appropriated in this way. No information is given as to how this amount is arrived at. It would be interesting to know what life the directors give to their dividend-paying mines and this information would be of especial value to the shareholders of the respective mines and would enable them to adopt the same cautious policy of making provision for redemption of capital.

The capital thus set free is being reinvested in new undertakings in the Transvaal, Rhodesia, West Africa and Siberia. It is noticeable that the company is apparently not investing much in the Transvaal but is turning its attention more to Rhodesia, West Africa and Siberia. With regard to Rhodesia the company's interests are described at some length by the consulting engineer, but with regard to West Africa and Siberia very meager information is given. It is known that the company has embarked on a considerable scale in West Africa and it is surprising that no detailed information is given as to the amount of money invested, as to the capital of the concerns invested in or as to their prospects. The company's balance sheet and profit and loss account are drawn up in the most condensed manner and no detailed information is given regarding the earnings on the expenditure, nor is there any list of investments.

The operations of the year have allowed of a dividend of 7s. per ordinary share being paid, a result which the shareholders will probably consider satisfactory. However, what they may fairly consider unsatisfactory is the non-communicative character of the report and accounts as regards detail. The investments of the company in West Africa and Siberia are dismissed in a few lines of the directors' report. There are no engineers' reports about these investments and no figures as regards expenditure. The lack of frankness regarding these important investments as well as the whole of the investments of the company is to be deprecated considering the standing of the Consolidated Goldfields of South Africa, capitalized today at about fourteen millions sterling. The directors owe to their shareholders not merely a general survey of the company's holdings but a detailed statement drawn up on business lines showing how, where and on whose advice the shareholders' money is invested. The report as it stands is of far too general a character and would not be tolerated by the shareholders of any important commercial company.

There are indications that the working of the ocean beach black-sand mines along the California coast will be undertaken again this winter. A number of beach claims have been located recently along the San Andreas beach below Aptos in the curve of Monterey bay, and farther south, especially near Point Sal, some beach mines are again to be operated. These beach mines or black-sand mines as they are generally called, will pay during one winter and then for three or four years seem to be almost barren. After a few years, however, it is said that they will again pay, the waves having meantime concentrated the material sufficiently to leave gold enough for profitable working. The beaches, however, cannot be worked steadily.

Discussion of Explosives in Coal Mines

The Experimenting Being Done Is Leading to the Production of an Explosive That Will Not Flame and Yet Will Not Shatter the Coal

BY FRANK F. MORRIS*

In view of the large amount of time and attention being devoted by experts, engineers, inspectors and operators to the subject of explosives for use in coal mines it should be of interest to those not personally in touch with the subject to become familiar with the distinguishing physical properties of the present day so-called "safety" explosive and particularly how it differs from black blasting powder which has been so long popular for use in coal mines.

There are a great many formulas being employed for "safety" or "flameless" powders but for the purposes of this article a powder has been selected which is made according to a formula popular among powder manufacturers and it has been chosen because it is probably as generally used as any "safety" explosive on the market today.

The black powder tested was a 3F powder of the type which has been in use in coal mines for years.

Chemical analyses of the two powders gave results as follows:

Black Powder.	
Sodium nitrate	71.08 per cent.
Sulphur	11.37 per cent.
Moisture	.32 per cent.
Charcoal	17.23 per cent.
	100.00 per cent.

"Safety" Powder.	
Moisture	5.30 per cent.
Nitroglycerin	28.43 per cent.
Sodium nitrate	31.51 per cent.
Carbonates	trace
Starch	20.71 per cent.
Wood pulp	14.05 per cent.
	100.00 per cent.

The physical tests were made by the use of special apparatus adapted to the purpose, which has been installed at the Allegheny Arsenal at Pittsburg, Penn., by the Government. This apparatus represents the most approved and modern methods of testing powder either at home or abroad. The best ideas of the various foreign testing stations have been put into practice, thus affording exceptional opportunities for a study of the subject under consideration. In this connection I desire to thank the officials in charge of the testing station for the free use of the apparatus out of working hours.

The physical tests made were in order to determine the following characteristics of the powders:

1. To determine the disruptive power.
2. To determine the merits of each powder when fired in the presence of gas or coal dust or both coal dust and gas.
3. To determine the heat developed upon detonation or the calorific value of the explosive.
4. To determine the rate of detonation.
5. To determine the quickness of the powder unconfined.
6. To determine the length and duration of the flame given off from a stemmed shot and also from an unstemmed shot.

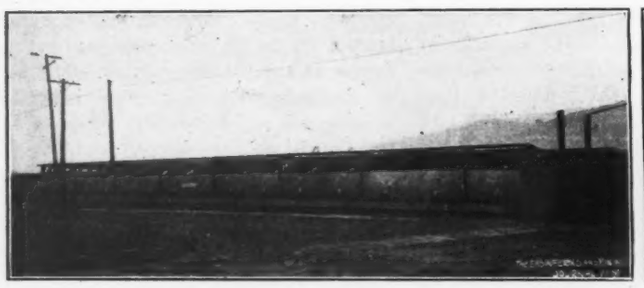

FIG. 1. THE NO. 1 EXPERIMENTAL GALLERY AFTER AN EXPLOSION OF GAS

FIG. 2. THE NO. 1 EXPERIMENTAL GALLERY AFTER AN EXPLOSION OF DUST

Tests on Disruptive Power

The disruptive power of the explosive was tested by three methods, namely; "the ballistic pendulum," "the Trauzl lead blocks" and "the Hichel pressure gages."

The ballistic pendulum method is the one adopted by the English testing station as the standard for determining the unit disruptive force of explosives. The pendulum at the Pittsburg testing station consists of a mortar weighing 31,600 lb. suspended freely on concrete pedestals.

In front of the mortar and placed on a track parallel with its direction of swing is a small cannon mounted on a truck. This cannon when assembled is 36 in. long and 24 in. outer diameter, having a smooth borehole 21½ in. deep and 2¼ in. diameter, centrally placed and extending longitudinally into the tube. In this the charge is placed and special methods used for obtaining standard conditions of tamping. After charging, the truck is rolled up until the face of the cannon is 1/16 inch from the muzzle of the mortar. It should be noted that the apparatus is so erected that the center lines of boreholes of the cannon and of the mortar are coincident.

The charge is electrically fired, the expansion of the gases producing a measureable swing of the mortar. This swing is determined by a recording device at the back of the mortar which may be read to 1/100 inch.

A charge of ½ lb. of 40 per cent. nitroglycerin dynamite is used as a standard for tests with the ballistic pendulum. The average of the results of a number of tests shows that such a charge produces a swing of 3.01 in. The problem then is to find what weight of charge of the unknown explosive is necessary to produce an equivalent swing of the mortar.

In charging the "safety" explosive it was tamped firmly with 1 lb. of dry fire clay. The black powder was tamped with 2 lb. of dry fire clay and hammered hard. Three tests were made with each powder and an average obtained, care being exercised that similar conditions were obtained in all tests. The results were as follows:

Average Swing by Recording Device.	
With 300 grams of "safety" explosive	2.99 in.
With 375 grams of black powder	3.02 in

Weight of Equivalent in Disruptive Power to One-half Pound of Standard.	
"Safety explosive	302 grams.
Black powder	374 grams.

From these results it is apparent that that 227 grams (½ lb.) of the standard 40 per cent. dynamite is equivalent in

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disruptive power to 302 grams of the "safety" explosive and to 374 grams of the black powder. These results determine the weight of charge used (unit disruptive charge) in ascertaining their relative merits in the presence of gas and dust.

Another method of determining the disruptive force of explosives is the Trauzl lead block. It is the standard method adopted by the Fifth International Congress of Applied Chemistry and is used at the Belgium testing station as the official means for determining the disruptive force of explosives.

The lead blocks used were cylindrical, 200 mm. in diameter by 200 mm. high. Each had, previous to being used, a central cavity 25 mm. in diameter and 125 mm. deep. In this the charge was placed.

The charges of the "safety" explosive were made up as follows: Three charges of 10 grams each were accurately weighed and placed in small tinfoil cartridges, a detonator containing 1½ grams of fulminate of mercury and chlorate of potash placed in the middle of the charge, the charge packed firmly and uniformly about the detonator and finally the tinfoil crimped over the top leaving the fuse wires extending out from the charge.

In like manner one charge of the black powder was made. These small cartridges were placed at the bottom of the boreholes of the several lead blocks used and carefully and uniformly tamped with 50 c.c. of dry sand. The cavities were measured before and after the explosion, the average enlargement produced by the three shots of the "safety" explosive being 169 c.c., while that by the black powder was only 19 c.c. An average of several shots of the standard 40 per cent. dynamite shows an enlargement of the borehole of 300 cubic centimeters.

It will be noted that the results obtained with the lead blocks are not comparative with those obtained by the pendulum. The gases formed in the case of the lead-block test with black powder have time to escape through the line of least resistance or the borehole before the point of maximum temperature and pressure is reached, whereas the contrary is true in the case of a rapidly detonating explosive like dynamite. The lead-block method of testing for disruptive power is therefore not reliable for comparing powders of different classes because of the introduction of the variable element, rate of detonation.

It should be observed that in the ballistic pendulum the pressure measured is that developed through the borehole, while in the lead blocks the contrary is true, the measurement being of the forces developed in all directions except through the borehole. If the gases formed in combustion are not developed quickly enough to exert pressure on the walls of the cavity before the pressure in the direction of the borehole is released, these gases will follow out through this line of least resistance and their strength be lost.

A Third Method for Determining the Disruptive Power

The third method used for determining the disruptive power of the explosives under investigation was by means of the Bichel pressure gages. These are two heavy cast-steel cylinders constructed with a view to withstand the very heavy pressures developed by explosives when detonated while confined.

By this method the products of combustion are retained and may be removed for subsequent analysis. The cylinders have capacities of 15 and 20 liters respectively. The smaller one is 80 cm. long and 50 cm. in diameter. The second one is of the same diameter but longer. These cylinders, which lay on their sides, are anchor bolted firmly into concrete pedestals. They are provided with strong steel caps which are bolted firmly into place against heavy lead washers, making an air-tight joint. A stout cross bar hooked and bolted over the cap further reinforces the joint. The gages are equipped with an exhaust pump by means of which a vacuum of 10 mm. of mercury column may be obtained; also a recording device for measuring the pressure developed.

By charging density, as referred to the use of explosives, is meant the ratio between the volume of the charge used and the volume of the chamber in which the explosive is detonated. In order to obtain the pressure developed in its own volume by any explosive it is necessary to know this charging density.

But it has furthermore been found that in the case of the Bichel gages, the superficial area of the inside of the cylinder exerts an immediate cooling effect on the gases so that the full pressure which could otherwise be obtained is prevented by this cooling surface. It is for this reason that the second gage was adopted. Whenever this gage is used, steel cylinders are placed in the chamber. These are of a size such that the volume of the chamber is always kept constant while increasing the superficial area. The volume of the chamber in all tests is 15 liters, the cooling surface being increased or decreased by the blocks used. By plotting the pressures against the cooling surfaces a curve is obtained which, if continued, intersects the line of pressures at zero surface area, thus determining the true pressures developed.

A series of calibrations were also made on the recording device. By these it was found that a movement of 0.56 of a mm. of the indicator-spring pencil showed a pressure per 1 kg. per sq.cm. developed against the walls of the chamber. A charge of 100 grams was used of the "safety" explosive and 200 grams of the black powder.

Results were obtained with three surface areas in the powders tested. Calibrations gave these areas as follows:

	Inside Surface Area.
With the small gage (capacity 15 liters)	3914 sq.cm.
With the large gage (capacity 20 liters with one large cylinder reducing capacity to 15 liters)	6555 sq.cm.
With the large gage (with three small cylinders reducing capacity to 15 liters)	7624 sq.cm.

To obtain the pressure developed in its own volume the pressure free from surface influence has but to be applied to the charging density. The results were as follows:

PRESSURE DEVELOPED.

	"Safety" Explosive.	Black Powder
Density of powder	.98	1.25
Pressure developed eliminating surface influence (kg per sq.cm.)	40.95	51.38
Pressure developed in own volume (kg. per sq.cm.)	6019.65	4816.9

Testing Gallery

Gas and dust gallery No. 1 consists essentially of a large steel cylinder horizontally placed; so made that gas may be introduced and retained for a short time; an exhauster and connections for stirring the gas and air mixture; suitable means for observing the action of flame along the length of the gallery; a cannon set at one end of the gallery and backstop barricades and other means of protecting property from the violence of explosions.

The gallery is 100 ft. long, 6 ft. 4 in. internal diameter, consisting of 15 sections of boiler-plate steel riveted together in in-and-out courses, centers on rivet lines being 6 ft. 8 in. The first three sections nearest the cannon are of ½ in. boiler plate.

The end of the gallery heads into a large reinforced concrete block in which is set the cannon. The axial line of the borehole of the cannon is coincident with the center line of the gallery and the face of the cannon is flush with the inner wall of the concrete head. The cannon used is of identical construction with the one used on the ballistic pendulum.

Along the top of the gallery at the center of each section is a circular release pressure door. In use these may be closed and fastened, closed and unfastened or left open. On the outer side of each section is a window made of ¾-in. plate glass, 6x6 in., used for observing flame at points along the gallery. At each rivet line on the inside of the gallery is a flange provided with studs. On these may be fastened semi-circular washers by wedges, thus providing a means of hanging paper diaphragms at different sections in the gallery. Diaphragms may also be placed on the doorways on top and held in place with heavy rings.

The gas feed is made from a 2-in. line connected with the mains of Pittsburg, thus offering a natural gas of similar

analysis to that found in the mines. A valve is placed in the line at every third section of the gallery providing a means for running the gas into the gallery at any or all of these divisions. The gas is run into the gallery over a very accurate test meter reading 1/20 cu.ft. and is fed into the gallery through a pipe extending 14 ft. along the bottom of the gallery and perforated in such a way that an equal flow of gas is maintained per unit length of the pipe.

The circulating system for mixing the gas with the air consists of a small exhauster connected in a 6-in. pipe line along the back of the gallery. The exhauster is cut off from the gallery by valves when not in use in order to prevent its destruction from an explosion. A second exhauster with connections is set on a truck and may be connected at any point in the gallery.

A series of four shelves on each side of the gallery running its entire length provides a means of distributing dust and is an approximation to mine conditions where dust is deposited along the ribs of the entries. Another means of introducing dust is made by placing a stout wooden "horse" in front of the cannon. This "horse" is 20 ft. long, the top is 12 in. wide and about 2 in. below the bottom of the borehole when set. In use, dust is spread along this board.

The lower end of the gallery is guarded by a barricade and backstop. The shot is fired electrically from a protected position about 60 ft. from the gallery.

Tests in Presence of Gas or Dust, or Both

The tests made were according to certain standard tests as adopted by the Government testing station in determining the safety of explosives. The conditions of these tests are described as follows:

"The charge of explosive to be fired in test Nos. 1 and 2 shall be equal in disruptive power to ½ lb. of nitroglycerin dynamite in its original wrapper of the following formula:

Nitroglycerin	40 per cent.
Nitrate of sodium	44 per cent.
Wood pulp	15 per cent.
Calcium carbonate	1 per cent.
	100 per cent.

"Each shot shall be fired with an electric fuse of sufficient power to completely detonate or explode the charge as recommended by the manufacturer. The explosive must be in such condition that the chemical and physical tests do not show any unfavorable results. The explosives in which the charge used is less than 100 grams, will be weighed in tinfoil without the original wrapper.

"The dust used in tests Nos. 2, 3, 4 and 5, will be of the same degree of fineness and taken from one mine.

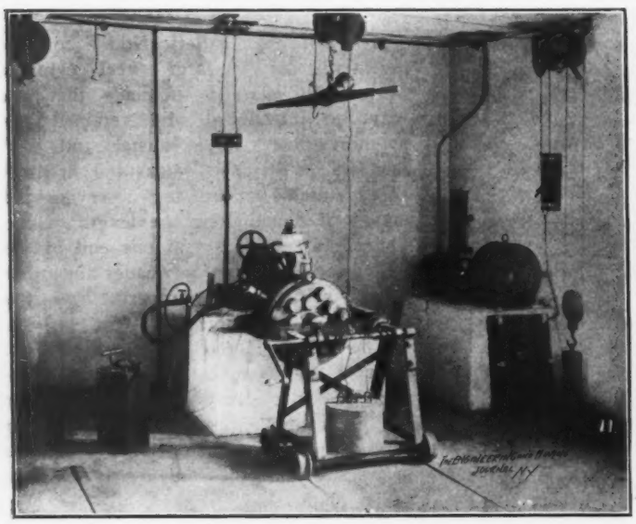

FIG. 3. SHOWING TESTING APPARATUS IN THE GOVERNMENT STATION AT PITTSBURG

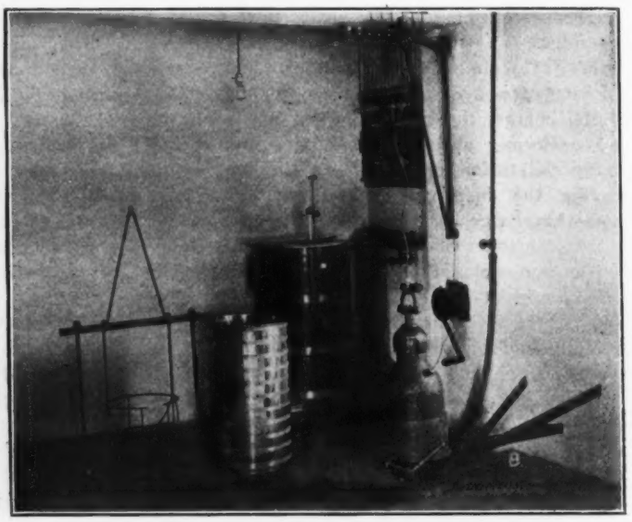

FIG. 4. ANOTHER CORNER OF THE PITTSBURG TESTING LABORATORY

"*Test No.* 1—Ten shots with the charge as described above, in the original wrapper, shall be fired, each with 1 lb. of fire-clay tamping, at a gallery temperature of 77 deg. F. into a mixture of gas and air containing 8 per cent. of methane and ethane. An explosive will pass this test if all 10 shots fail to ignite the mixture.

"*Test No.* 2—Ten shots with charge as previously noted in its original wrapper, shall be fired each with 1 lb. of fire-clay tamping at a gallery temperature of 77 deg. F. into a mixture of gas and air containing 4 per cent. of methane and ethane and 20 lb. of coal dust, 18 lb. of which is to be placed on shelves laterally arranged along the first 20 ft. of the gallery and 2 lb. to be placed near the inlet of the mixing system in such a manner that all or part of it will become suspended in the first division of the gallery. An explosive will pass this test if all 10 shots fail to ignite the mixture.

"*Test No.* 3—Ten shots with charge as previously noted, in its original wrapper, shall be fired, each with 1 lb. of clay tamping at a gallery temperature of 77 deg. F. into 40 lb. of coal dust, 20 lb. of which is to be distributed uniformly on a "horse" placed in front of the cannon and 20 lb. placed on side shelves in sections 4, 5 and 6. An explosive will pass this test if all ten shots fail to ignite the mixture.

"*Test No.* 4—A limit charge will be determined within 25 grams by firing charges in their original wrappers unstemmed at a gallery temperature of 77 deg. F. into a mixture of gas and air containing 4 per cent. of methane and ethane and 20 lb. of bituminous coal dust, to be arranged in the same manner as in test No. 2. The limit charge is to be repeated 5 times under the same conditions before being established.

"*Test No.* 5—A limit charge will be determined under the same conditions as in test No. 4, except that 2 per cent. of methane and ethane will be used instead of 4 per cent." The two explosives under examination were subjected to the above tests and all confirmatory tests made. Following is a brief summary of results:

Tests with the Safety Explosive

Test No. 1—"Safety" explosive failed to ignite gas mixture on any of the 10 shots fired. Black powder ignited gas mixture. Flame came from doorways 1 to 7 inclusive and was visible in windows 1 to 9.

Test No. 2—"Safety" explosive failed to ignite gas and dust mixture on any of the 10 shots fired. Black powder ignited gas and dust mixture. Flame came from doorways 1 to 9 inclusive and was visible in windows 1 to 13.

Test No. 3—"Safety" explosive failed to ignite dust on any of the 10 shots fired. Black powder ignited dust. Flame

came out of all doorways and was visible in all windows extending 10 ft. out from the end of the gallery. Charred dust was found along the floor of the gallery.

Tests Nos. 4 and 5—Because of the failure to pass the first three tests it was deemed useless to subject the black powder to further tests where it would be fired unstemmed. The "safety" explosive passed tests Nos. 4 and 5 with a charge of 1000 grams (2.2 lb.) this being the largest charge used for these tests.

Heat Developed on Detonation

Two tests were made with each powder by the calorimeter to determine the amount of heat disengaged by the explosion.

The *explosives calorimeter* consists essentially of the following parts; the calorimeter bomb, the inner receiver or immersion vessel with tub, a thermometer reading to small fractions of a degree, and a hooking frame.

The bomb is bottle shaped of ½-in. wrought steel and has a capacity of 30 liters. The charge is hung by the detonator wires from the connection through an insulated plug to an exhaust valve. The top of the bomb is covered by two caps which may be made tight by a screw plug and heavy lead washers. The bomb is 30 in. high, weighs 158 lb. and is handled to and from the immersion vessel by a small crane.

The inner receiver is a cylindrical sheet copper, nickel-plated tub, 30⅞ in. deep and 17⅞ in. inner diameter. In this is placed the water in which the bomb is immersed during a test.

The other tub provides an enclosure for the working parts of the apparatus. The stirring device consists of a series of rings with a horizontal bearing surface. It is operated by a ¼-horsepower motor. The thermometer used extends through a one-holed rubber stopper set in the cover. It registers to thousandths of a degree.

The customary methods for calorimetric determinations were employed. A series of thermometer readings before and after firing of the charge made it possible to make any corrections necessary for the influence of the air on the rise in temperature. Previous calibrations gave the water equivalent of immersed parts and the calorimetric value of the detonator. These corrections being applied, the averages of the results of two tests on each explosive were as follows:

Average large calories developed by one kg. of "safety" explosive	722.13
Average large calories developed by one kg. of black powder	788.53

A charge of 100 grams of the "safety" explosive and 200 grams of black powder was used for the tests.

Rate of Detonation and Rate of Burning

Tests were made to determine the speed with which the explosive wave travels through the charge. For this purpose a device known as Mettagang's recorder is considered the most accurate of all test methods known. The principle of the device is electrical throughout. Two circuits, obtaining their current from 12 dry cells connected in series, are connected through induction coils to two very delicate needle points set about ¼ mm. from the surface of a soot-covered drum. One pole of the secondary coil is connected to the bearings of the drum. The circuits are passed through separate ends of a cartridge file containing the explosive to be tested, the connections being made just 1 m. apart. A separate set of wires connect the detonator, which is placed in one end of the cartridge, to the firing battery. When the explosive wave breaks the circuits, sparking is caused at the needle point, which makes a small dot on the periphery of the drum. When the drum is revolving rapidly the difference of time between the sparking of the two points is determined by measuring the distance between the dots. A very accurate vibration tachometer is direct connected to the shaft of the drum and indicates the number of revolutions per second of the drum from 50 to 150.

Measurements are made of the distance between specks by means of an eye piece equipped with cross hairs, and a sealed disk with pointer connected to a worm gear which may be meshed with teeth on one side of the drum provided for the purpose. These are so made that one revolution of the pointer will advance the periphery of the drum one milimeter.

A reading may be obtained with accuracy to 0.01 mm. The drum may be driven 100 revolutions per second. The periphery of the drum is ½ m., so that a peripheral speed of 50 m. per second may be obtained. This gives the possibility of obtaining a reading of one-five millionth of a second. The highest speed which the device has been called upon to record at the United States testing station is 22 one hundred thousandths of a second, which is equivalent, approximately, to a velocity of the explosive wave of three miles per second.

The charge of the "safety" explosive used was prepared by cutting off the ends of six cartridges and placing them end to end in a tube, thus making a continuous cartridge about 42 in. long. This cartridge was hung in a covered pit which had been equipped for the purpose in a protected location.

In the case of the black-powder test a stout tube was used open at one end only. Connections were made similarly to those of the "safety" explosive. In this case the fuse was inserted in the open end of the tube and in order to retain it in position it was held in place by a seal of plaster of paris.

The average of two tests on the "safety" explosive showed the rate of detonation to be 3470 m. per sec. One test on the black powder indicated its rate of burning to be 312 m. per second.

Quickness of Explosives

In order to determine the quickness of explosives, that is, the relative time intervals in which the gases are completely formed, it was found convenient to fire the charges unconfined. To obtain a measure of the pressure developed in one direction, a small lead block was used. These blocks are 2½ in. long and 1½ in. in diameter.

One hundred grams of the explosive are placed on top of the block in a paper cartridge which has been previously pasted to the block, care being taken that the density of the explosive is the same as in the original cartridge. In order to prevent a shattering of the lead upon firing, a small steel disk ¼ in. thick and of like diameter with the block is placed in the tube before the charge.

The block when thus tested suffers a deformation due to the pressure developed by the charge, the amount of which depends upon the quickness with which the gaseous products of combustion are developed. In slower explosives the gases have time to escape in other directions of less resistance than that offered by the block while in the case of explosives of rapid detonation, these gases are formed so quickly that the effect is more or less felt by the block.

Three tests were made with the "safety" explosive but only one with the black powder. This was sufficient to show that the gases would never gain enough force to compress the block under these conditions. The powder merely burned slowly.

The average compression caused by the "safety" explosive was 13.08 mm. After the black-powder test no difference in the hight of the block could be detected.

Length and Duration of Flame

Tests were made of the explosives under examination to determine the length of flame and the interval of time during which it was in existence with the charge confined and unconfined.

A cannon, like the one described in the ballistic-pendulum test, is placed on end at the base of a steel cylinder 43 in. in diameter and 20 ft. high. A slit is cut in one side of the cylinder, the bottom of the slit being a trifle lower than the top of the cannon. Connecting the cylinder with an adjacent building is a light-tight steel conduit which also incloses the slit. This conduit is horizontal on the bottom and sloping on the top from 8 ft. 3 in. at the cylinder to 21 in. at the building. The slit is 2 in. wide and 8 ft. long.

At the point where the conduit intersects the building, is located a photographic dark room. The line of sight is arranged to pass through the conduit and slit and center line of the borehole of the cannon. The film is fastened to a drum which, when set in position in the box, is geared to a motor and may be driven at a peripheral speed of 20 m. per second as registered by a tachometer. In front

of the drum and but a fraction of a centimeter from it is a stenopaic slit 3 in. long and 1/16 in. wide, thus allowing only the smallest fraction in width of light to penetrate to the film.

The charge is placed in the cannon, the top of the cylinder is covered with black paper, the drum, with the film tightly fastened on, is started and when the proper speed is indicated by the tachometer, the shutter is opened and the shot fired.

When developed, the negative shows in the case of detonating explosives unstemmed, a light streak at an angle with the vertical. The angle is caused by the speed with which the drum is being driven at the time the picture is taken and is a measure of the time during which the flame was in existence. The hight of the light streak is a measurement of the hight of the flame.

It has been determined by calibration that 19 mm. on the negative is equivalent to a hight of flame of one foot. Knowing the peripheral speed of the drum it is necessary only to apply it to the lateral displacement of the flame image to determine the duration of the flame.

Three shots were made with the "safety" powder stemmed with 1 lb. of dry fire clay and three were made unstemmed. One shot only was made with the black powder unstemmed and one stemmed. The result of the unstemmed black powder was so marked that it was thought unnecessary for the purposes of this article to confirm it. The stemmed shot of black powder gave indications of flame but the picture was not sharply enough defined to obtain a measurement of it. However. by referring to the picture it can be seen that there is nearly as much flame as with the "safety" powder shots unstemmed. No flame was shown by the stemmed shots of the "safety" powder.

The following are the calculated results of the flame tests:

SAFETY POWDER.

	Stemmed.	Unstemmed
Calculated hight of flame (inches)	No record.	10½
Calculated duration of flame (seconds)		0.0003

BLACK POWDER.

	Stemmed.	Unstemmed.
Calculated hight of flame (inches)	See text.	.30
Calculated duration of flame (seconds)	See text.	0.93

SUMMARY AND CONCLUSIONS

As explained at the beginning, the two explosives under examination are employed for the same purposes in coal mines and can, therefore, be placed in comparison judging them from the same standpoint.

The element of cost may be mentioned briefly and in a general way. The manufacturers of the type of "safety" explosive used in the preceding tests claim that if used properly and not wastefully, the cost of shooting down coal ton for ton will not exceed that incurred by the use of black powder and in some cases has been known to cost less. The latter is probably the exception rather than the rule and it is generally considered that in ordinary use, the coal operator will pay a little extra for the "safety" explosive for the benefit of the element of protection it affords to his employees and property.

Such conclusions as are here drawn, however, will be based entirely upon a comparison of the explosives according to their physical properties, without consideration to the element of cost.

The ballistic pendulum combines the conditions necessary for determining the coal-getting qualities in better proportion than any other of the tests made. The coal-getting qualities of a powder depend upon two things, viz: its disruptive power and rate of detonation For example, an explosive such as pure nitroglycerin has the property of developing high pressures, as can be shown by detonating it in a vacuum as in the Bichel pressure gages but if a charge of nitroglycerin were used in a borehole to shoot coal, a large proportion of the energy would be wasted in shattering the coal in the immediate surroundings of the charge and very little used in throwing the body of the coal down. On the contrary, should a charge of an explosive with a minimum rate of detonation be used, even though it might show high pressures on the Bichel gage, the tendency when charged in a borehole in a coal mine would be too strongly toward developing its pressure along the line of least resistance, which might be the borehole, depending upon the angle with the horizontal which the borehole made, the amount of tamping used or other conditions of boring or tamping. Such a condition would both destroy the value of the shot and introduce a large element of danger.

It is necessary, then, to have an explosive combine the elements of disruptive power and rate of detonation in the proper proportions in order to obtain the best coal-getting qualities. The ballistic pendulum has been found by practice to determine this better than any other known testing apparatus.

Referring to these tests it will be noted that a charge of 302 grams of the "safety" explosive will do work equivalent to 375 grams of the black powder. This identifies it as a "stronger" powder; that is, a unit weight will accomplish more work. In shooting coal it would probably shatter more than the black powder because its strength is confined to a smaller volume, the gravity of the two explosives being almost identical. (See gravities given under records of Bichel gage tests).

FIG. 5. THE BALLISTIC PENDULUM FOR TESTING EXPLOSIVES AT THE PITTSBURG ARSENAL

The results on the Trauzl lead blocks are of value only in showing the marked difference in rate of detonation of the two explosives. Whereas the gases were formed quickly enough to cause an enlargement of 169 c.c. in the case of the "safety" explosive, scarcely any perceptible effect was shown by the black powder, the gases escaping through the line of least resistance, viz: the borehole.

The Bichel gages give results which are due wholly to the pressures developed. This is the most accurate means for determining the disruptive power of explosives which was used in the foregoing tests and in fact is considered the best

known method for obtaining the pressure developed by explosives in their own volume.

Up to this point the relative merits of the powders have been confined to considerations of their ability to do work. The tests in gas and dust gallery No. 1 show their respective merits of safety. The weights used in the charges on these tests are well within the limits of the average amount used per shot in coal mines. It will also be observed that the black powder was confined with 2 lb. of dry fire-clay tamping instead of 1 lb. as in the case of the "safety" powder. This afforded a safer condition for the black powder to be fired under. The conditions under which the charges were ignited were as nearly as possible an approach to actual mine conditions as could be obtained above ground.

Test No. 1 used 8 per cent. gas which is near to the most explosive mixture of gas and air that can be obtained. The pressures developed by the ignition of this mixture by the black powder were very high. Such a condition in a mine is made possible by a rapid feeder or even a slow feeder where there is insufficient ventilation to remove the gas as it is formed.

Test No. 2 used 4 per cent. gas with 20 lb. of dust. Two pounds are partially in suspension at the time the shot is fired. The actual weight of dust suspended in the gallery at the time of the shot is a very small fraction of the 2 lb., but is sufficient to cause a dense cloud similar to that caused by the current of air created at the rear of a rapidly moving trip of cars along an insufficiently sprinkled entry.

Coal Dust Will Explode without the Presence of Gas

Test No. 3 used coal dust without gas. Ignitions under these conditions controvert the belief that existed among mine men up to a recent date that coal dust unaccompanied by gas would not ignite. Such results as have been obtained at the United States testing station at Pittsburg, however, have conclusively shown that the dust itself when acted upon by flame of sufficient intensity or duration will either become ignited with explosive rapidity or will distil gases which will, as soon as formed, create an explosive mixture.

Tests 4 and 5 impose very strenuous conditions upon the powder used. Unstemmed as the charge is, there is nothing in the way to prevent any flame that may be formed from acting upon the gas and dust present in the gallery.

The results of these tests are apparent. The "safety" explosive passed all conditions imposed upon it while the black powder failed in every particular. Although no results were obtained with the black powder without tamping, it is safe to assume that a very low weight would ignite the gas, for, as was observed in the flame test, a large amount of flame is emitted from a very small charge.

The results of the calorimetric determinations are very interesting and favorable to the "safety" powder. To avoid heat and flame are the two main objects in obtaining safety in explosives. Black powder develops a comparatively small amount of heat when fired but a great deal of flame. The contrary is true of a well balanced nitroglycerin dynamite. The nitroglycerin "safety" powder used develops not much more than half the heat produced by the same weight of a 40 per cent. dynamite. This is caused by changing the formula in such a manner as to form CO instead of CO_2 when the powder is detonated and also by the mechanical introduction of moisture. In this way, the heat developed by the "safety" powder is less than that caused by the ignition of an equal amount of the black powder.

The results of the rate of detonation test show one reason for the popularity of the black powder among mine operators who find a market for lump coal. The explosive wave travels over 11 times as fast in the "safety" powder as in the black powder. By reason of this property, black powder "heaves" the coal and produces a minimum of slack. The "safety" powder, on the contrary, owing to its property of more rapid detonation might tend to produce a higher percentage of slack than black powder.

The results of the rate of detonation test are confirmed by the results of the small lead blocks in determining the relative quickness of the explosives.

Photographs of the flame test largely explain the results of the gallery tests. No flame could be detected by the camera when the tamped charge of "safety" powder was fired, and when untamped it was apparently quick enough to prevent an ignition of the gas or dust when tested in the gallery. On the contrary, the black powder shows flame whether tamped or untamped and in the latter case it was of long duration.

Safety Explosives Approved

Briefly, then, the "safety" powder is in a measure, properly so-called. It meets the requirements of mine conditions and gives protection to the miners even though they may be obliged to work under dangerous conditions. On the contrary it meets the objections of the operators because of the lowering in value of their product, and the objections of many of the old school of miners because of the ease of handling the black powder, necessity of thawing the nitroglycerin explosive and kindred arguments brought about by long familiarity with the black-powder type of explosive.

It is claimed by the promoters of "safety" explosives in general that an intelligent use of their product will cause no more slack than with the black powder and this has been demonstrated by use in anthracite and harder grades of bituminous coal. It is still open to question what can be done in the softer bituminous coals. Probably if the proper charge could be used to prevent increasing the slack, it would cause a larger amount of pick work to be done by the miner. An attempt has been made to overcome this difficulty by making an explosive lower in percentage of nitroglycerin.

It is safe to assume, however, that the day of the "safety" explosive is here. There are many opportunities for improvement of the present form and these improvements are gradually being brought about by persistent research work. When these minor objections to the present-day "safety" explosive are met, minor because the money that is lost by destruction of a small per cent. of coal is nothing when compared to the enormous loss of life and property in the colliery disasters, when these objections are met and a full realization of just how large a share the use of black powder has had in causing these disasters, the "safety" explosive will take the lead and black powder for use in coal mines will be a thing of the past.

The Free Entry of Miners Rescue Appliances

In a letter to the collector of customs, at Chicago, Ill., the Secretary of the Treasury says: "Sir: Paragraph 628 of the tariff act of August 5, 1909, provides for the free entry of 'miners' rescue appliances, designed for emergency use in mines where artificial breathing is necessary in the presence of poisonous gases, to aid in the saving of human life, and miners' safety lamps.'

"As the obvious purpose of this paragraph is to aid in the saving of human life, the same should be given the most liberal interpretation. You are, therefore, instructed to admit to free entry all miners' rescue appliances and parts thereof, such as helmets, special tubing of valves, special oxygen cylinders, refilling oxygen pumps, and all other essential parts of the complete outfit, whether imported as entireties or in separate parts.

"Under the provision for miners' safety lamps, you should admit to free entry miners' safety lamps, whether electric, or designed for using oils or other illuminating materials, with or without glass chimneys, and whether imported as an entirety or in separate parts, together with any apparatus for locking or unlocking such safety lamps, for testing or detecting flaws in these lamps, or for cleaning them of dust particles, etc."

Coal Mine Accidents and Their Prevention

By J. A. Holmes*

Our coal industry in its phenomenal growth has nearly doubled during each succeeding decade of the past 60 years. It has had to do more than keep pace with our increasing population, for while it supplied less than 1 ton of coal per capita to the American people in 1880, it has had to supply nearly 6 tons per capita during 1908. Its growth has been too rapid for systematic development, and the industry today represents a great host of scattered, warring, discouraged elements, without organization or coöperation.

In this industry are now employed some 600,000 miners, who work at some 6000 different mines, and produce yearly about 500,000,00 tons of coal.

Not only is the nation increasingly dependent upon this coal for its heat, light and power for its manufacturing industries and transportation facilities, but this coal and other mineral products now contribute in tonnage more than 65 per cent. of the total freight traffic of the country.

The economic conditions upon which coal mining is based in this country are fundamentally bad; and the evil consequences are so far-reaching as to both time and extent, and are so essentially national in character that this subject demands the earnest consideration of our best statesmen, as well as of our best engineers.

1. In spite of this rapid growth in our demand for coal, the normal productive capacity of our coal mines under continuous operation greatly exceeds this demand.

2. Ruinous competition exists not only between the operators in the same field, but between the operators of one field as against those in another field, or in another State, where different mining laws and regulations exist.

3. This competition is first of all driving out of the business the small operators except where they find protection under local freight rates; and is forcing even the larger operator to mine coal under conditions which he cannot approve, but from which he finds no escape. If he and his fellow-operators endeavor to "get together" and place the price of coal at the mine on a reasonable basis they go to jail under either a Federal or a State statute; and as the only alternative each must live (or succumb) by underbidding the other, which he can do only through wasteful and unsafe mining methods.

Note—Address delivered before the National Civic Federation in New York, November 23.

*Expert in charge, Technologic Branch United States Geological Survey.

4. Even when the demand for coal and the prices are at their best, under existing conditions, the operator can mine only that part of his coal which can be taken out most cheaply and sold at higher prices; and the remainder must be left underground in such shape as may preclude its future recovery. And thus we waste yearly more than 250,000,000 tons of the nation's fuel supply.

5. The American mine owner is as humane as is the mine owner of any other country, and he would like to follow every practice and use every appliance for safety to be found in Britain, or France, or Beglium, or Germany, or elsewhere; but he pays his miners higher wages, and at the same time receives for his coal at the mine less than half the price received for similar mined coal by the operator in these countries; and he must employ miners, an increasingly large percentage of whom come to him unfamiliar either with the practice of the industry or with the language or traditions of the country.

6. And the penalty which *the nation* is paying for this bad system, is this increasing waste of resources and the still more unpardonable increasing waste of human life—the yearly loss of 250,000,000 tons of coal, and the killing or injuring yearly of from 8000 to 10,000 men.

What Are the Remedies for This Bad Situation?

The remedies for the evil are:

(a) Investigations, such as are now being conducted by the Government, as to the causes of mine explosions; and other similar investigations as to the causes of mine accidents of other kinds, and as to methods of prevention.

(b) Educational work among the miners and the lower active mine officials as to these causes and remedies.

(c) The training of men at each mine as to the best methods of using explosives, using electricity, handling of gases and dust, of timbering, of preventing and extinguishing mine fires; as to the methods of rescue work, and as to the methods of first-aid-to-the-injured work.

(d) The development of better and more uniform mining laws, rules and regulations, based upon accurate data and experience.

(e) Active, determined coöperation between the miners and the mine management and the State's inspectors in the enforcement of these rules and regulations with a view to the maintenance of the safest possible conditions in every mine.

The above are all parts of the program for lessening and alleviating mine accidents; but they do not complete the program. It is an essential part of this program that—

(f) The ruinous competitive system upon which coal mining in the United States is based at the present time should be changed, and that the price paid for coal at the mine should be such as will permit and secure safe and efficient mining—mining unaccompanied by either this large loss of life or waste of resources—mining which can have due regard to not only the safety, but also to the health and the comfort of the men who toil underground and whose labor is so essential to the welfare of the nation. All this can be done without adding appreciably to the burden of the average American citizen; without any increase in the price of coal at the poor man's cottage, and without the risk of any unreasonable restraint of trade.

There can be no permanent industry without reasonable profits. It is unjust and irrational that in this great and essential branch of industry, reasonable profits should be dependent upon any unnecessary sacrifice of human life, and unnecessary waste of resources which we can neither replace nor restore and which will be essential to the future development of the country.

This industry needs and deserves fair treatment at the hands of the American people, and upon the receipt of such treatment depends in no small degree not only the welfare of the operators—though nobody cares about them—but also the welfare of the 600,000 miners who risk their lives in supplying the fuel for the nation's industries, and the heat and light for the nation's comfort and convenience.

In the case of Washoe Copper Company against Junilla *et al.*, involving a conflict between placer and quartz locations on the same ground the Montana district court has rendered a decision against the mining company and in favor of the quartz claimants. The ground comprises a large tract in the southern part of Butte, and was located many years ago under the name of the Jones placer. Some years after the placer location, one Colbert made a quartz location of the same ground. The placer claim was then patented, and the Washoe Copper Company in the course of time became the owner. The quartz claimants started to work the ground last year and were enjoined by the Washoe Copper Company. The finding of the court is to the effect that at the time the placer claimants applied for a patent they knew of the existence of a quartz vein within the property, and, applying the law which prevails under such conditions, the court decreed that the quartz claimants were entitled to 25 ft. on either side of the vein, which lies within the placer claim.

The American Iron and Steel Manufacturing Company, Lebanon, Penn., announces that it will install a plant for the production of 50,000 to 60,000 tons of steel billets per annum in an electric furnace. This will be consumed entirely in the finishing mills of the company.

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**Illustrated.*

The "Guggenheim" Coppers

According to the last annual report of the Guggenheim Exploration Company its investment in Utah Copper Company was $4,788,468; in Nevada Consolidated, $1,671,589; in Nevada Northern bonds, $1,650,000; in Cumberland-Ely, $912,808. The Nevada Northern bonds were convertible into Nevada Consolidated stock at $5 and have lately been so converted. We may estimate roughly that the Exploration company owned 240,000 out of the 733,000 shares (issued) of Utah Copper and 320,000 out of the 1,600,000 shares of Nevada Consolidated (previous to the recent increase). The Guggenheim interests are commonly credited with a larger ownership in Nevada Consolidated than is indicated above and doubtless have important holdings individually or through other companies. For its Cumberland-Ely holdings, as to which it is difficult to guess, the Exploration Company probably received a considerable part of the 400,000 shares of new stock. These companies are commonly known as the "Guggenheim" coppers. The Guggenheims have possessed the undivided management of Nevada Consolidated and Cumberland-Ely. Utah has been in the hands of the McNeill-Jackling-Penrose interests, but the Guggenheims have been influential.

It is now proposed to consolidate these companies, absorb Boston Consolidated, and later buy the Garfield smeltery and Baltimore refinery of the American Smelters Securities Company, so as to make a powerful copper producing combination, of which the capital is to be $150,000,000. Evidently this is a result of the check to the larger plan. Its purposes may be surmised. The introduction of sufficient water at this time may make it easier to combine with the Cole & Ryan and Amalgamated interests later on, when a further dilution will not attract so much attention, distribution may be inaugurated, and in the meanwhile curtailment of production may be effected by tacit understanding. Why else should there be a Guggenheim consolidation? Boston Consolidated is useful to Utah Copper Company, but why should Nevada Consolidated go into any combination unless it be to sell out at a handsome profit? The real interest in this project will develop when the matter of valuations is published.

It is gossiped that 2½ or 2¾ shares of Boston and 2 or 2¼ shares of Nevada will be rated as equal to one share of Utah. This corresponds roughly to present quotations in the market, wherein at least two of these stocks are being over valued. Such a basis would appear to be a good exchange for Boston, which seems to be badly needed by Utah and is taking advantage of its opportunity, but it looks as if Nevada Consolidated, which has the best physical conditions and equipment of the three, and to many minds the best mines also, would come out of the small end of the horn. The valuation of these properties is an extremely difficult job and we should not lightly criticize what has doubtless involved many engineering conferences unless it be known that expert opinion has been put aside because of trading necessities. Outside stockholders of Nevada Consolidated will doubtless resist any absorption that is not upon an absolutely fair basis. Anyway it is a pity to see such a successful, substantial and self-contained company lose its identity in a consolidation.

Tularosa Copper Company

The Tularosa Copper Company is capitalized for 1,000,000 shares, of which 500,000 are pooled until sufficient funds have been raised to build a mill of 300 tons daily capacity, and 500,000 shares are in the treasury. Sale of 50,000 shares of the latter stock at $1.25 is now being promoted by Irving K. Farrington & Co. Although we cannot agree to some of the statements of this firm respecting Tularosa, we are bound to say that the enterprise is presented with commendable frankness in so far as the company itself is concerned, there being among other things a report by H. Vincent Wallace, a reputable engineer, of Nogales, which appears to be correct as to facts, but to the ignorant this frankness requires some interpretation.

According to Mr. Wallace development work has proved a body of ore about 180x105x45 ft., and a positive and probable tonnage of 85,398 is reckoned, 8564 tons having been already mined and milled. Three bore holes are regarded as proving the continuity of the orebody for 1800 ft. north of the main shaft, but no record was kept of these holes and Mr. Wallace properly says that it is essential to do some more drilling. From 8400 tons of ore milled there was obtained 333 tons of concentrates, averaging 37.64 per cent. cop-

per, or 1.49 per cent. per ton of ore milled. Loss in tailings was 1 per cent., indicating a copper tenor of 2.49 per cent. in the original ore. When, however, Mr. Wallace proceeds to estimate that with a plant treating 100 tons of ore daily there is going to be an extraction of 86 per cent. of the copper in the ore at a cost of $1 per ton for mining and milling and a cost per pound of refined copper of 8.4c., which may be reduced to 7.4c., we fear that he is rather too optimistic. The Ray Consolidated engineers estimate that in milling 4000 tons per day of about the same grade of ore the copper cost will be 9c. per lb., but few outside engineers expect that to be realized, although in the case of Miami, milling 2000 tons daily of a higher grade of ore, that figure will probably be attained. The Tularosa orebody appears to lie near the surface and may be able to yield copper at 7.4@8.4c., if big enough to be mined by steam shovel, which is not yet known.

The plan for Tularosa contemplates erection of a 100-ton mill as the first unit of a 300-ton plant. For a 300-ton mill there is at present less than one year's ore supply developed. Anyway, it is scarcely wise to undertake to exploit commercially an ore deposit of 2½ per cent. grade on so small a scale as 300 tons daily, and hopes for speedy dividends on the basis at present outlined are likely to be disappointed. The Tularosa, according to the report of Mr. Wallace, appears to be a prospect that is not yet ripe for extraction of ore. Instead of proceeding to erect a mill the company should become acquainted with its orebody, first by drilling, then by underground developments. We are informed by the company that drilling is now being done. The enterprise should be presented to the public as a prospect, not as a mine, and distinctly it should not be made a subject of inflation on the Curb market. Nor should the promoters interested in selling the treasury stock say that "the net value of the present ore reserves represent an amount equivalent to over $3 per share on its entire issued capitalization," and indicate that with the mill in operation the stock will advance to at least $10 per share. Insofar as the company itself is concerned its plans and operations appear to be straightforward in the prosecution of a legitimate scheme of mining development.

The Copper Statistics for November

The figures for November were about what was expected. Deliveries under the large sales of that month were not to get into full swing until December. As recorded for November, the deliveries, both domestic and foreign, were about the same as in October. Production mensually decreased, but November had only 30 days, and really there was a repetition of the same old story—an increasing production—the daily rate having been 4,053,846 lb. against 4,021,216 in the previous month. That there has not yet been any amelioration of the unfavorable statistical position is shown by the total of 389,861,127 lb. as the visible supply in Europe and America on Dec. 1, compared to 376,076,026 at the beginning of November. The great increase in American consumption dates from May or June, but since mid-year the world's accumulation has increased 85,000,000 pounds.

Those who anticipate a rosy improvement in the showing for Jan. 1 are likely to be disappointed. The visible supply in America will probably be less, but that of Europe will be more. Such diminution as there may be will be chiefly the conversion of visible into invisible supply. The shutdown of Montana smelters will not affect the refinery output for December.

It seems now to be recognized that no great improvement in the statistical position of copper is to be expected right away unless there be a curtailment of production. The projected consolidation having been deferred there is talk of a curtailment by tacit agreement among some of the large producers. So we live in hope. But the chief question of interest is: Who is going to curtail?

Safety Chambers in Coal Mines

The disastrous fire at the St. Paul mine in Illinois has caused coal-mine operators to realize that the dangers from mine fires are as great as those from explosions of gas and dust. The latter accidents are likely to occur more frequently, but certainly are not more serious.

This latest fatality has shown how necessary, as a matter of safety, are fireproof shafts and bottoms. We have also been brought to realize that a complete equipment of fire-fighting apparatus is essential at every well organized coal mine. The most important incident that directed attention to the Cherry disaster, however, was the dramatic rescue of 20 miners after seven days' entombment. This, combined with the knowledge gained from pitiful messages found on the bodies of other miners, who after days of imprisonment perished in the St. Paul mine, are strong arguments favoring the installation of safety chambers underground.

Outlines of plans for building such stations have been published in the JOURNAL from time to time. One large Illinois coal company has prepared plans for an underground safety chamber, which station is to be supplied with oxygen tanks, food supplies, medicine, etc., besides being connected to the surface by a bore hole, permitting the extension of a telephone line to the chamber.

In our issue of March 6, 1909, page 507, we published a paper on "The Isolation of Certain Mine Areas from Contact with the After-Gases of an Explosion." The idea as advanced by Mr. Robinson, the author of the paper in question, was to install a series of boiler-plate doors in the main entry, the intakes and the return roadways. Mr. Robinson in his article conceded that the inner doors in the explosion panel would be blown from their fastenings, but asserted that the outer doors would remain intact, and the men behind them might be saved.

Notwithstanding the skepticism of chronic doubters, intelligent mine managers will lend ear to every new plan that is a sensible endeavor to safeguard our mines. Money cannot be employed more wisely than in providing precautions to insure lives and property.

The threat of a strike by the labor organizations against the United States Steel Corporation to force the latter to abandon its open-shop policy will probably fail to attract much attention. The unions have already done about all they can to bring the Steel Corporation to terms and have failed. On the other hand the Steel Corporation is recognized to have been eminently fair in the treatment of its employees, wherefore a strike to force it to abandon the open-shop principle would command but little sympathy.

Stamp Mills as Coarse Crushers

In commenting on the work of the Mines Trials Committee, the *South African Min. Journ.*, Oct. 9, 1909, points out the fact that novel ideas in mill construction are being carried out practically in the connection with new plants. Those ideas are, in brief: The use of stamps as coarse crushers, employment of tube mills for secondary grinding, and the removal of amalgamating tables to another department of the works.

Experimental work in the field of crushing capacity and efficiency which has been carried out by the Mines Trials Committee has shown that crushing to a mesh of nine to the square inch in the mortar boxes, with final reduction to the necessary grade in tube mills, is a working arrangement which represents the limit of economy with machines in use. Upon this basis a result of 15 tons per day has been obtained by means of stamps weighing not more than 1400 pounds.

The importance of this achievement lies first of all in the great reduction of the capital expenditure necessary to obtain an equivalent daily product as compared with present methods, and it is this matter of capital expenditure which has constantly stood in the way of an attack upon the enormous quantity of low-grade ore, which represents so large a percentage of Rand banket reefs. The design of the stamps themselves, and the mortar box, has naturally been under investigation in the various tests, and the arrangement of long heads and short stems, as adopted at the new City Deep mill, has met with unqualified approval.

The open-front mortar box, also, a mortar box with that section of the casting removed which extends from side to side above the screen, has secured favorable opinion. In conjunction with heavy stamps especially are its merits apparent, for it renders access to them much more easy. In some which have been tried the top of the box has been lowered quite successfully to the level of the water-feed opening. Whether any diminution of strength in the box results from this design is perhaps an unsettled point, but it is worthy of remark that in one instance the cutting out of the front has been followed by a springing together of the sides to the extent of about 1/16 in.; a fact which indicates a relief of strain in some portion of the castings.

The new scheme of reduction which relegates the stamp mill to the somewhat inferior position of a coarse crusher opens the way to a consideration of the merits of other machines which have heretofore been handicapped in competition with it, and it seems not unlikely that attempts will now be made by the makers of other types of crushing machines, such as rolls and the like, to reassert themselves. In various directions, then, the experiments of the Mines Trials Committee in the matter of crushing efficiency alone appears destined to have a far-reaching effect, not only upon the Rand but elsewhere.

The McArthur-Forrest Cyanide Patents in Mexico

The latest rulings on the McArthur-Forrest patents in Mexico were recently made the subject of a paper by Leopold Salazar and published in the *Informes y Memorias* of the Instituto Mexicana de Minas y Metalurgia. The following extracts show how the government stands on the subject of the expiration of these patents:

The first term of the principal patent No. 399, had already expired, and that for the extension had commenced, when the government, on October 1, 1903, promulgated a new patent law which is still in force. The term for the duration of a patent is thereby fixed at 20 years without regard to the date of its granting or the term for which it was granted in other countries, it being optional for the inventors to take advantage of this change, which the Mexican Gold and Silver Company naturally did, thereby securing an unexpected extension of another year, inasmuch as the 20 years would end October 19, 1907. The company, however, claimed that in addition to this they had a right to the special extension of 5 years, asking in effect a patent for 25 years.

The company made valiant efforts to obtain official recognition of this view, and failed. The decision of the President of the Republic was communicated to the company October 17, 1906, in the following concise terms: "The caducity of the patent will be declared Oct. 19, 1907."

The company made persistent efforts to obtain a reversal of this decision by means of legal proceedings, but before the courts could come to a conclusion Oct. 19, 1907, arrived, and the patent office, in the absence of any orders to the contrary, published in the *Diario Official* the following notice: "In accordance with the administrative declaration of Oct. 17, 1906, and Art. 40, Sec. 3, of the law on the subject, the termination is hereby declared of Pat. No. 399 for a process to extract gold and silver from their ores or compounds, granted to McArthur and Forrest."

Relief was now sought by the company in the district courts, which demanded a report from the secretary of Fomento, which was delivered in the following terms: "That to admit the suspension of process would mean that at the expiration of the 20 years of a patent, and the 5 years' extension, a lawsuit of 2, 3 or 4 years' duration might be instituted, the company enjoying in the meantime a practical monopoly. The Department of Fomento, in virtue of its mission to protect the liberty of industry, cannot countenance such proceedings."

In consequence of the firm stand taken by the department, the supreme court, on June 4, 1908, gave the following verdict: "The court does not protect the company against the official acts of the patent and trademark office, which declared Pat No. 399 to have expired, ordering the publication of this declaration." It will be conceded by all who have studied the matter, that the government acted in accordance with high ideals of progress and the legitimate interest of the industry.

Mining in the Murchison Range, Transvaal

SPECIAL CORRESPONDENCE

The report of the H. E. Proprietary, in the Murchison range, Transvaal, states that owing to the absence of railway communication the cost of prospecting and opening up claims in the Murchison range has continued to be an almost insuperable obstacle to any activity on a large scale. Since the close of the financial year a change has taken place in the railway position. Two lines to the northern district have been approved by Parliament. Both will be to the advantage of the company. The proposed extension of the abandoned Selati line to Leydsdorp, which lies at the southwestern end of the Murchison range, will connect that area with Delagoa bay, while the line from Pietersburg to Bandolier Kop will open up the far northern districts of the Transvaal.

ANTIMONY IN THE FREE STATE MINE

The Murchison range is situated between the Selati and Groot-Letaba rivers. Geologically it consists of a narrow belt of schists bounded on either side by granite. These schists contain numerous auriferous quartz veins, fahlbands and general impregnations of a lenticular nature which conform both in strike and dip with the adjacent beds.

There are two main auriferous horizons. On the one is situated the Blue Jacket mine, and on the other the Free-State mine of the H. E. Proprietary. The latter appears to be the most highly mineralized portion of the range, and is noted for its extensive deposit of antimony. The antimony-gold deposits occur in the string of kopjes which extend in a northeasterly direction from a point north of Leydsdorp to a distance of about 30 miles. The antimony is present as stib-

nite, but near the surface is represented by its yellow decomposition products.

The H. E. Proprietary's holding in the Free State mine is unchanged. No work has been done during the year. The mine is opened up to a depth of 600 ft., and it will be advisable to allow work to remain in abeyance until the railway has brought about a change in general working conditions.

Blue Jacket Mine

A small portable mill has been installed upon the Blue Jacket property, and a total of 1200 tons has been crushed for a recovery of £2852. A considerable amount of gold is stated to have remained in the tailings, and a small cyanide plant is in course of erection to treat the residues. The experiment has shown that work can be carried on profitably on the small but rich reefs of this district, but the cost of development and supervision will of course be high until ores can be treated on a large scale.

In regard to this experiment the chairman of the Johannesburg Committee reports as follows: "In general the results obtained by this experiment are promising and go to show that it will be possible to work at a profit the claims containing rich leaders. A number of these are known to exist, and it is probable that small mines will be started in the low country in the near future. It has been further ascertained that one or two reefs in the Blue Jacket contain fair ore, but not sufficient development has been carried out to determine the approximate payable tonnage contained in these low-grade orebodies. They go to show, however, that after further development and careful exploitation of these small rich reefs the Blue Jacket will prove payable when lower working costs are possible in the district."

With regard to the company's interest in the Magato concession, the directors report satisfactory progress in the negotiations. The Transvaal government has recognized the new grant in favor of the men who had expended money on the old Magato grant, and a clause to that effect has been inserted in the new gold law which came into force last January.

Large Diamond Found in Orangia

Two portions, weighing 174 carats, of a large diamond, have been found in the Voorspoed mine, Orangia. The larger portion is 116 carats, blue-white, and valued by one competent authority at £2500; another estimates it at £30 per carat. The other portion of the stone is off-color and not nearly so valuable. The Voorspoed is one of the largest diamond pipes in South Africa and is the only payable large pipe discovered during the last 14 years.

The Chief Consolidated, Eureka, Utah

The Chief Consolidated Mining Company is an organization originating in the copper country of upper Michigan and the principal stockholders are identified with the mining business there. The company's property consists of 10 mining claims, of which it possesses full ownership with the exception of three claims in which the company owns one-half. In addition to these, it owns, through its control of the Eureka City Mining Company, nearly the whole of the underground rights of the townsite of Eureka, thus giving it the total ownership of nearly 400 acres of mineral ground in the Tintic district of Utah.

By acquiring the stock of the Little Chief Mining and Milling Company it has secured for itself the shaft and mining equipment of that company. The shaft has reached a depth of nearly 1700 ft. and it is intended to continue sinking to 1800 ft., which depth will represent for the time being the bottom working level.

The plan of the company and the scheme of its organization, as outlined by Walter Fitch, the president and general manager, was the development of an ore channel, which was presumed to run through the length of its territory and parallel to the ore channel on which the Centennial-Eureka mine is located, and from which also the Bullion-Beck, Eureka Hill, Gemini and Ridge & Valley mines have taken out many millions of dollars in metals. That a parallel channel does exist has already been demonstrated, says Mr. Fitch, by the work done by this company, and though the company was only organized in the middle of February, it has already forwarded to the smeltery, within the last 30 days, a little over 1000 tons of ore, which has netted, after payment of all transportation and smelting charges, slightly over $24 per ton. The ore zone was developed and the ore discovered in the northern part of the territory and shipments are being made continuously from this deposit.

As it is estimated that the mines above mentioned have paid in dividends an amount exceeding $18,000,000, and the Mammoth and Grand Central mines to the south of the Chief Consolidated Mining Company's territory have earned fully one-fourth of that amount, the management of the Chief Consolidated believes that it has good promise for the future.

The company is employing about 50 men at the present time, has just completed the erection of a six-compartment ore bin and also has finished the erection of an assay office and is now building a machine shop of sufficient size to meet the requirements of the mine. It will complete its construction work and equipment by the installation, in the near future, of a new hoisting plant of the first-motion type with the capacity of handling two 2-ton skips in balance, and in connection with this it will have a new boiler equipment with mechanical stoking attachment.

The outstanding capital of the company consists of 810,000 shares, par value $1. It has in its treasury 190,000 shares and approximately $150,000 cash. All of its property is fully paid for and it has no outstanding indebtedness with the exception of that for the current month's business.

Smelting in Bond

Special Correspondence

Treasury officials who had been expecting to issue the regulations governing the smelting of lead ores in bond under the terms of the new tariff have again deferred their action. It is expected that instead of taking final action within a short time, as had been intended, the department will now defer all action until the latter part of January or the beginning of February, if not longer. The special agents of the department who have been at work investigating the questions of wastage, the conditions of transportation of the ores, the giving of bonds, etc., are reported to have found their work unexpectedly complicated and difficult. Pressure had been experienced from the smelting interests for early action, but this has now been partially withdrawn, those interests having somewhat changed their demands. This change of front is responsible for the renewed delay in the matter.

The Bureau of Mines Bill in Congress

Special Correspondence

At a preliminary meeting of the Senate Committee on Mines and Mining, on Dec. 9, the question of legislation creating a bureau of mines was discussed and its importance urged by Chairman Dick. The meeting served to develop the existence of some unsuspected opposition due to conditions the precise character of which is still somewhat uncertain. The friends of the bureau of mines bill have not lost courage and still maintain that there is a better chance for the success of this measure at the current session than at any time in the past.

Several concessions for plants for smelting zinc ore have been granted recently by the Mexican government. A project for an extensive zinc plant at Torreon or Sabinas in the state of Coahuila is being advanced by Alfred E. Rodriguez, who has mining interests in the northern part of Mexico.

Hydraulic Landing Chair *

By M. Clapier

Until 1902 the output from the Marseille shaft of the Montrambert collieries was handled by two double-decked cages, carrying two mine cars on each deck. The guides, which were placed against the short sides of the cages, were of oak, 18x15 cm. in section. The landing chairs at the bottom were of the ordinary sliding-bolt pattern, and the manipulation of the cages was done from the surface. From a depth of 456 m. the above arrangement permitted an output of 150 to 160 mine cars per hour. In 1902, the double-decked cages were replaced by cages having three decks, but the same guides and landing chairs were retained; the maximum possible output then rose to 180 cars per hour. In 1904, the principal working was done on the 516-m. level, and it became advisable to invent a system of landing chairs for the bottom of the shaft which should obviate the necessity of manipulating the cage from the top.

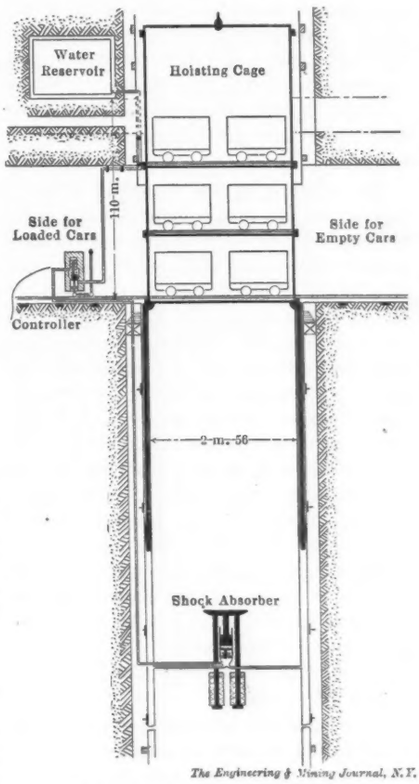
The device consisted essentially of a piston sliding in a cylinder into which water under pressure could be admitted, the flow of water in and out being regulated by a valve. In this way it would be possible to lower the cage step by step, removing the empty and putting on the loaded cars at each step. The pressure of the water was to be such that it would force the unloaded piston upward to its limit, but would not support the weight of the cage, even if unloaded. The downward motion could, of course, be arrested at any position by simply closing the valve. The three following conditions, likewise, had to be met: The new chairs must not obstruct the shaft and must leave the guides clear for future hoisting from a greater depth; the shock of the descending cage must be cushioned to prevent rupture of the piping system; the old chairs must not be interfered with, but must be left serviceable for use if anything should happen to the hydraulic chairs.

To satisfy the first requirement, two cylinders were provided for each cage, and the cylinders and piston rods were imbedded in the guides themselves. The cylinders were made rectangular, 15x18 cm. in section, and replaced the wooden guide for a distance below the landing. The head of the piston, on which the cage rested, was made so that it could be turned through 180 deg., so as to allow the cage to pass unobstructed if desired. The four cylinders were then united, by pairs, to the pressure main so that each cage could be manipulated by a single valve.

The second requirement was fulfilled by connecting to the pressure main a cylinder in which worked a piston having a bearing against two sets of springs. A sudden shock would compress the water and the compression would be taken up by the springs. A throttle valve prevented the too rapid recovery of the springs, so that the cages would be restored to their proper position automatically and quietly. The third requirement was met very simply by putting in behind the cylinder-guides oak timbers carrying the sliding parts of the old chairs.

Capacity Increased

The pipe connecting the several cylinders had a diameter of 49 mm., while



HYDRAULIC LANDING CHAIRS

the pipe from the shock equalizer to the storage reservoir was of 20-mm. diameter. The admission and escape of water from the cylinders were governed by a special valve mounted in a box like a controller. The valve was of the spindle variety, having a bronze seat. The upper side of the valve communicated with the chair-cylinders, while the lower side was connected to the reservoir at a distance of 110 m. above the landing. The valve was operated by a lever which lifted it from its seat and thus made communication from the pressure main to the cylinders.

When the cage was not on the chairs, the pressure of the water main lifted the governing valve, admitting water to the cylinders and raising the chairs to their highest limit; when they had reached that point, the valve closed by itself. When the cage struck the chairs, the shock was absorbed by the equalizer, and the added pressure forced the controlling valve more firmly upon its seat. When the cage had recovered its initial position, under the action of the cushioning springs in the equalizer, the cars were changed on the lower deck. The controller was then opened, allowing water to escape back into the mains, and the cage descended to the second deck, at which instant the valve was allowed to shut. When the cars had been transferred here, the valve was again opened, allowing the cage to sink to the level of its upper deck, but was stopped this time by some permanent blocks underneath. As soon as the cage lifted, the chairs returned automatically to their upper limiting position.

By the use of these chairs, the possible output was raised at once from 180 to 250 and 280 cars per hour. Repairs to cages likewise diminished from an average of 10.75 to 5.75 cages in the repair shop per year. The cost of maintaining cages in good condition thus showed a remarkable diminution, due to the more gentle handling that they received. Repairs to the hydraulic apparatus amounted to almost nothing.

*Abstract from *Compt. Rend.*, March, 1909.

Iron Ore Deposits along the Ottawa and Gatineau Rivers

The iron ores of the valleys of the Ottawa and Gatineau rivers have been the subject of an investigation by Fritz Cirkel for the Mines Branch of the Canadian Department of Mines, and his report has just been published. The publication of this report comes at an opportune time, owing to the recent developments in the smelting of iron ores by electricity, the region in question possessing much available water power.

The various iron-ore deposits in the townships of Hull, Templeton, Wakefield, Bristol, Grenville and others are described in detail and the conclusion reached that many of these would yield ores which in all probability could be treated profitably in the electric furnace. It is claimed that this method of reducing the iron ores can compete with the blast furnace for the production of pig iron, when electrical energy can be developed at a low cost. An appendix to the report gives a synopsis of the water-power resources, both developed and undeveloped, in the region under consideration. The following falls can all be developed to produce large quantities of power: Paugan falls; Cascades; Chelsea rapids; Great falls; Coulonge river; Roche Fendue; Calumet falls; Chats falls.

At the smeltery of the Tennessee Copper Company at Copper Hill, Tenn., ore from El Cobre, Cuba, containing 9 per cent. sulphur, is being used to line converters.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

Aluminum

What is the tensile strength of aluminum. A-G. M. M. Co.

About 25,000 lb. per sq.in. Modulus of elasticity, about 12,000,000. Allowable tensile strength for pure aluminum is about 6000 lb. per sq.in. and the compressive strength somewhat greater. Some alloys of aluminum are stronger.

Value of Tungsten Ore

What is the present value of tungsten ore and the recent range of the market? X. Y. Z.

Early in 1907 wolframite concentrates containing upward of 60 per cent. of tungsten trioxide fetched in the neighborhood of $6.50 per unit. By the middle of 1907 the price had advanced to $11. In December there was a recession and sales were made at prices ranging from $5.50 to $7. By a unit is meant 20 lb., or 0.01 of a ton; for a 60-per cent. concentrate the value is, therefore (taking $7.50 per unit for example), $7.50 × 60, or $450 per ton. In 1908 the value ranged from $5 to $6 per unit. At present the quotation is $6 per unit.

Conversion of Copper Sulphide into Sulphate

Is there any method employed other than heap roasting for converting copper sulphide into sulphate, and leaching with water? If so, what is it and where is it used? C. L.

Copper sulphide can be converted into sulphate in almost any kind of roasting furnace if the temperature, air supply, etc., be properly controlled. However, we are unaware that copper sulphate (bluestone) is commercially prepared in America, either in this way or by heap roasting. If it be done by the latter, it must be on a comparatively small scale. The bluestone of commerce is obtained either as a by-product in the refining of lead and copper, or as a direct product by the treatment of scrap copper or granulated copper with sulphuric acid. In Germany, we believe, some copper sulphate is still made by the oxidation of copper matte. An ingenious method for the manufacture of bluestone from copper matte that was formerly used at Kansas City, Mo., is described in "The Mineral Industry." Vol. VIII.

Excessive Wear of Plates

Can you refer me to any publication or articles, dealing with the subject of grinding ore in cyanide solution, followed by plate amalgamation? Briefly, our practice is to grind in Bryan mills, through 30-mesh screen, using about a 0.125 per cent. KCN solution, and amalgamating on plates in front of the mills, adding no mercury inside the mills. The sands and slimes are then cyanided separately.

The amalgam on the copper plates is dry and hard, and is only removed by using a steel scraper. Little mercury is held by the plate, a considerable portion running at once to the bottom. After six months' use with cyanide solution the plates show considerable wear from the solvent action of the cyanide and at the lower end are especially thin. Do you think that any combination metal, as Muntz metal for example, would prove more satisfactory than copper and give longer wear? G. W.

The practice at the Goldfield Consolidated mill, Nevada, includes milling in cyanide solution with amalgamation after stamps and again after tube mills. No description of practice or developments in that mill has been published except such as were prepared from mill designs and flow sheets before the completion of the plant. At the mill of the Bodie Consolidated Company, Mono county, Cal., crushing is done in cyanide solution of 2 lb. per ton, the pulp flowing from the stamps over ordinary copper tables. The copper dissolves in time, leaving rough holes and sharp edges and, until they are entirely beyond repair, it is the custom to patch the holes with pieces of old plate. We believe that Muntz metal has been tried at that plant. The manager of either of the above plants would no doubt give the desired information.

The trouble due to hard amalgam might be attributed to unusual fineness of gold, rather than to lime or cyanide. At Gold Cross, with 100 stamps working with water in the battery on $3 ore, it was a constant struggle to keep the plates soft. The method there was to go over the plates twice a day, first rubbing vigorously with pumice stone of fist size, working up every dry spot of amalgam, using a moderate quantity of quicksilver and finishing with a whisk broom. If the plates in question have been allowed to accumulate a thick coat of hard amalgam it were better to begin with pumice after the next clean-up rather than attempt to work it all up at once. Much pressure and hard rubbing with pumice is an essential.

At one mill under construction the copper plates had not arrived when the mill was ready, so a sheet of linoleum was laid on each copper table with the idea of preventing leakage through the joints of the latter. Part of the mill feed was old tailings and it was not long until amalgam began to adhere in spots on the linoleum. These spots were carefully nursed and the entire surface was ultimately coated. So long as the linoleum was not scraped clean of amalgam, it served exactly as well as copper. This scheme might be tried at little expense if the destruction of copper plates is a serious item.

Combined Conveyer and Slime Filter

Can you tell us the inventor or manufacturer of a slimes filter described as follows: The construction is like a belt conveyer; the first carrying pulleys on it revolve in a horizontal position, the other pulleys up to the center being so placed as to work at graduated angles. These pulleys come closer together until in the middle they are perpendicular. The pulp is thus pressed close together, the solution being gradually squeezed out, after which the belt opens out again. N. G., Ltd.

A somewhat similar scheme was tried in Guanjuato by E. J. White, of the Guanajuato Development Company, in squeezing thickened pulp between belts. The experiments developed the fact that the slime cannot be squeezed between non-porous belts, it merely flowing, while with one porous and one not porous the capacity is very low and no wash is possible.

Flexible Joint Pipe

I am desirous of obtaining information regarding the feasibility of laying large diameter water pipe across the bed of a swift-flowing river. The line contemplated is to be of 30-in. pipe, to carry water under a pressure of 133 lb. per sq. in.; the river bed is shingle and irregular. In this region only pipe bridges have heretofore been used, so except for the information given in Trautwine's 1907 edition, page 661, we have nothing to guide us. F. R.

In general, such an installation is feasible, the J. G. White Engineering Company of New York, having recently laid two lines of this type, one across the Hudson river, and the other across New York harbor. In any case, however, the engineer in charge must determine on the adaptability for the conditions at hand. After the work has been properly planned, it is largely a question of construction. Such lines are usually designed for a maximum deflection from the horizontal of 12 deg., but for special cases, this angle may be increased to 30 deg., and in any case, an ample allowance for sag should be made. In laying the pipe line, more than two or three lengths of pipe should not be allowed to hang free from the barges, etc., as too great a stress is put on the compression side of the line. Flexible pipe with ball joints is used for this work. The John F. Ward flexible joint is in general use. Cast-iron pipe is adapted for the work and the United States Cast Iron Pipe Company of New York, deals in this material.

Details of Practical Mining

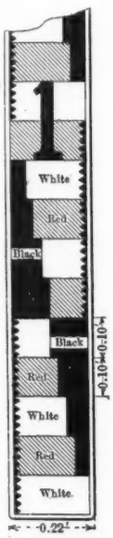
Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

REPORTS FROM EXPERIENCE

Readers of the JOURNAL are invited to contribute to this department. Articles should be brief, thoroughly practical, and preferably illustrated by drawings or sketches. Our draftsmen will prepare properly any kind of a pencil sketch that is intelligible. Something that is an old story in one district may be quite unknown in another. Articles accepted and published are suitably paid for.

The Florida Stadia Rod

The Florida stadia rod is described by William MacDonald in *Eng. News,* Oct. 28, 1909, as follows: The Florida rod is only 0.22 ft. wide and is usually made 10 ft. long. The only figures are the foot



FLORIDA STADIA ROD

marks. Tenths are indicated by alternate white and red blocks on a black ground; they are stepped for the first ½ ft. one way and for the upper ½ ft. in the opposite direction. The hundredths are shown by serrated edges as per the accompanying illustration.

It will be noted that from point to point of the teeth is 0.02 ft., and each 0.01 ft. is indicated from point to bottom of teeth. If in close reading, say, for instance, in measuring a stadia circuit, even closer readings are desired, they can be obtained as the diagonal side of the tooth can be subdivided by the eye. If only approximate readings are looked for, the white and black spaces can be subdivided by the eye.

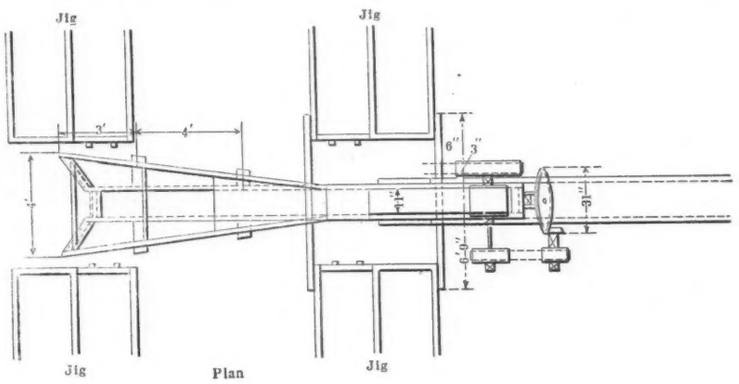
Mr. MacDonald has also designed a target with a horizontal slit for laying off instrument hight, which makes this the all-round best rod for topographic surveys.

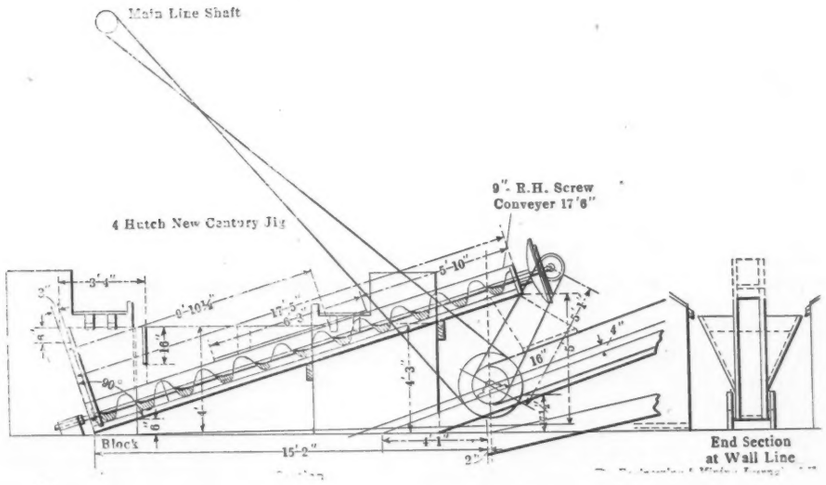
Dewaterer for Jig Tailings

The screw conveyer shown in the accompanying illustration has given satisfactory results as a dewaterer for jig tailings at the hard-rock mill of the Bertha Mineral Company at Austinville, Va. At this mill various screening and other dewatering devices were tried and either proved unsatisfactory or had to be abandoned on account of excessive wear. The screw conveyer, however, has been found to deliver jig tails containing practically no free water, and the water from these tails contains only slimes. Satisfactory results were obtained on material as fine as 30 mesh operating the conveyer at speeds varying from 10 to 50 r.p.m. The conveyer handles the tailings from four Harz jigs, and with coarse material the power consumption is quite small.

In the same mill screw-conveyer dewaterers set vertically have been tried to handle various products. Using a smooth-bore cylindrical shell about the screw, difficulty was experienced from fine material slipping through and clogging the space between the screw blade and its inclosing tube.

This difficulty has been overcome by opposing the screw blade by a narrow metal strip riveted to the inside of the tube so as to form a sort of rifling. Using a tube 8 ft. high and 9 in. in diameter and rifled in this manner, material of jig-





METHOD OF SETTING UP SCREW CONVEYER AS DEWATERER

ging size can be successfully elevated 4 ft. above the water level without excessive power consumption. An ample opportunity for water to drain off is thus afforded and the material delivered is so dry and compact that no water can be squeezed from it by the hand.

Mining Methods in New York Tunnels

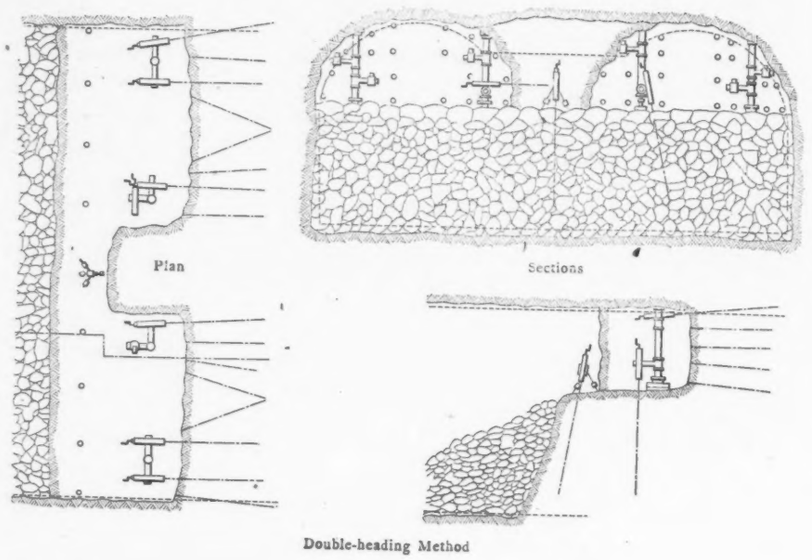
In driving the twin cross-town tunnels in New York City for the Pennsylvania Railroad, three methods were employed by the contractors in solid rock; double heading, single heading and full-sized heading. These methods are described by James H. Brace and Francis Mason in *Proc.* A. S. C. E., October, 1909. They differed only in the manner of drilling and blasting. The bench was usually within 10 to 20 ft. of the face of the heading.

The bench was about 13 ft. high and was drilled by tripod drills, but owing to the lack of head room, steels long enough to reach the bottom of the bench could not be used. Tripod drills were set as low as possible at the foot of the bench and drilled lifting holes, inclined 10 to 15 deg. to the horizontal, and spaced to converge at the location of the drainage ditches. The accompanying drawings show the placing of machines and holes.

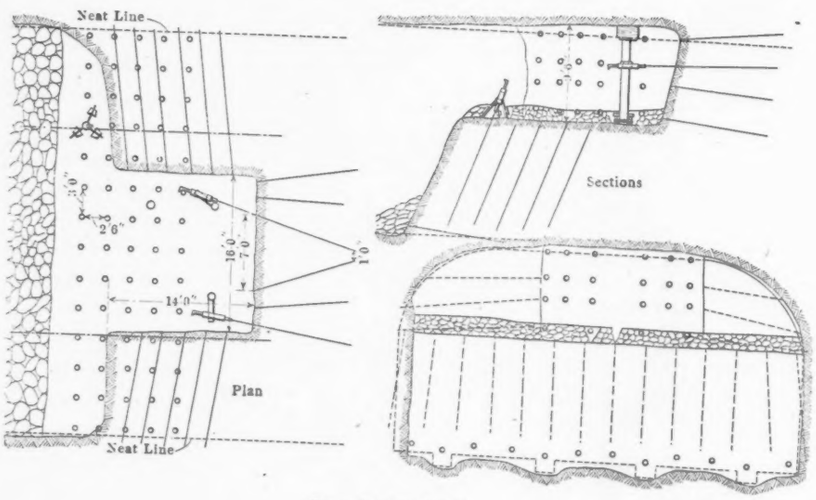
In the double-heading method the top headings for each tunnel of the pair were driven separately, leaving a short rock core-wall between them. The headings were drilled from columns and the dividing wall by a tripod drill. The core-wall was fired with the bench.

In the center-heading method only one heading was driven. It was rectangular in shape, about 8 ft. high and 14 ft. wide, and situated on the center line between the tunnels. In general, the face was 6 to 12 ft., or the length of one or two rounds, in advance of the remainder of the face at the top. The center heading was drilled by four drills on two columns. By turning these drills to the side they were used for holes at right angles to the line of the tunnels, by which the remainder of the face of the heading was blasted. By turning the drills downward, the bench holes under the center heading were also drilled.

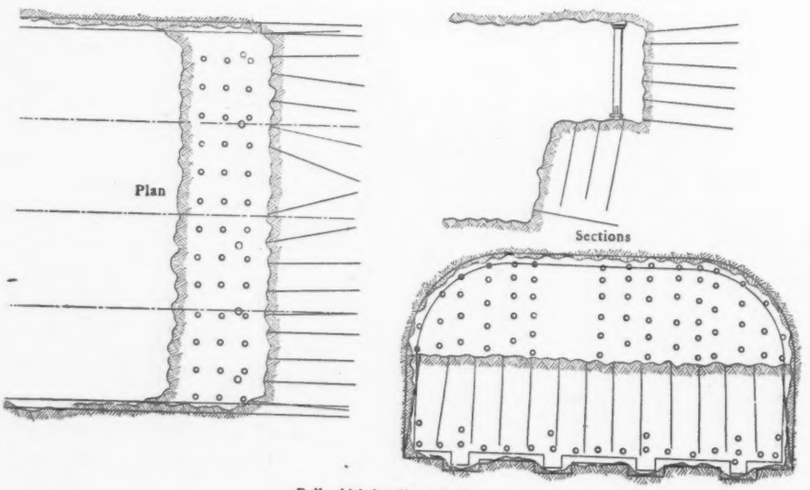
For the full-width-heading method ten drills were mounted on five columns set abreast across the face. Holes were drilled to form a cut near the center line between the tunnels. The remainder of the holes were placed so they would draw into the cut. The bench was frequently drilled from the same set-up of columns by turning the drills downward. In sound rock this method proved to be the most rapid.



Double-heading Method



Center-heading Method



Full-width-heading Method

The Engineering & Mining Journal, N.Y.

MINING METHODS IN NEW YORK TUNNELS

Self Acting Mine Doors

A device, used in a German mine, by which a door across an airway can be opened automatically by an approaching car or trip is illustrated in the accompanying Fig. 1. The rail *G* is supported horizontally, at about 2½ ft. above the ground, by two stulls on one side of the track, in such a way that the end of the rail toward the approach of a car is closer to the track than the other end. A slotted shoe *B* slides on this rail. Fastened to it is one end of a rope which passes around suitable pulleys, the other end being fastened to the outer edge of the door. A counterweight *g* is also connected to the sliding shoe to assist its return movement, if the usual pressure is insufficient.

A car coming in the direction of the arrows strikes the shoe *B*, and by pushing it ahead opens the door; by the time the door is open wide the shoe has traveled sideways far enough to allow the car body to pass it, but the door is prevented from closing by the springs *s*, which rub along the side of the car. When the car has passed, the natural weight of the door, which is purposely hung out of plumb, assisted by the wind pressure and the counterweight, causes it to close.

Another method of accomplishing the same result, in the case of a heavy haulage road traversed by electric locomotive, is shown in Fig. 2. The doors are made of sheet iron, and the joint between them is made more air-tight by wooden and leather strips. The pulleys on the inner ends of the levers *b* and *c* are connected by wire rope. The lever *c* presses against the roller *f*, while the spring *g* presses in the opposite direction so as to insure the closing of the door after the trip has passed. The locomotive or car, coming against the levers *b*, transmits its pressure to the levers *c*, and the door opens.

Disposal of Tailings

Formerly, the tails from the old Bertha soft-ore mill containing from 16 to 19 per cent. zinc, and about 35 per cent. solid matter, were settled in small ponds, shoveled out by hand, loaded into barrels (only 50 lb. of solid matter to the barrel), elevated and run in a car to the dump from which they were drawn as required by the oxide furnaces of the Bertha Mineral Company at Austinville, Va. A 3-in. Morris centrifugal pump was installed, and now the tailings from the mill are pumped directly out upon the dump pile. The same amount of material as formerly required six men 20 hours to handle is now disposed of in two hours, and the labor of only one man is required to watch the pump. The mixture as delivered by the pump only contains about 25 per cent. solid matter, but as it is only drawn from the outside of the dump pile where it has had time to drain, just as satisfactory results are obtained as formerly, and with a very great saving in labor and time.

Stamp Heads

There is no question as to the advisability of having stamp heads made of steel instead of cast iron. A few years' use will wear down the lower edge of a cast-iron head to the breaking point. The removal of broken stem stubs is usually a difficult and tedious job, where cast-iron heads make the use of a pinch of giant powder inadvisable. Particularly is the job difficult if a stem must be removed without removing the stamp head from the mortar. The difference between the cost of cast iron and cast or chrome steel is a mere $25 in a five-stamp mill, and this difference is soon offset by saving of time and profanity.

A Core Drill Hole of Unusual Size

L. C. Glenn, professor of geology at Vanderbilt University, sends the following brief description of two core-drill holes of unusual diameter that have recently been completed by the Nashville Gas Company, of Nashville, Tenn. These holes are 41½ ft. deep, and are believed to be the largest holes of the kind in existence. Each bore hole is 23½ in. in diameter and a 20⅜-in. core was obtained. The material bored through is Ordovician limestone. A contract was given to the National Elevator Company, of Cincinnati, Ohio, and a special drill was made by the American Well Works, of Aurora, Ill. The core barrel is about 12 ft. long and is geared to rotate 28 to 30 times per minute. The cutting was done with crushed chilled steel.

The rate of cutting averaged about 10 in. per hour, the best record being 14⅝ in. in 55 min. The two holes were put down in two weeks. The limestone core weighs 400 lb. to the foot, and although 12-ft. lengths might have been cut it was deemed best on account of the great weight to break and pull the core in lengths of 3 to 5 ft., though one piece of core was 9 ft. long and looked as if it were a turned stone column to be used for some architectural purpose. The cost of a hole of this size is roughly about $10 per ft. and the driller thought there need be no difficulty in going several hundred feet if such depth were desirable. Two sections of this monster core are preserved in the museum of Economic Geology at Vanderbilt University.

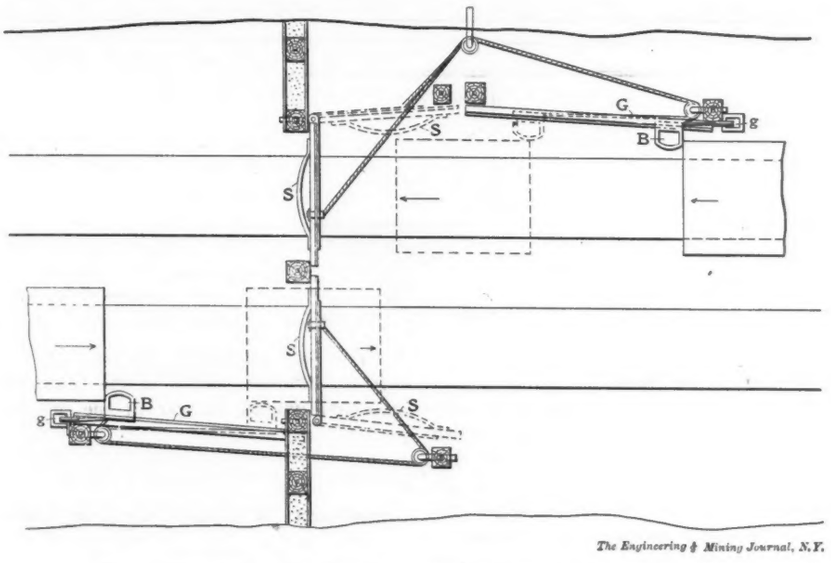


FIG. 1. SELF-ACTING MINE DOORS FOR DOUBLE TRACK DRIFT OR TUNNEL

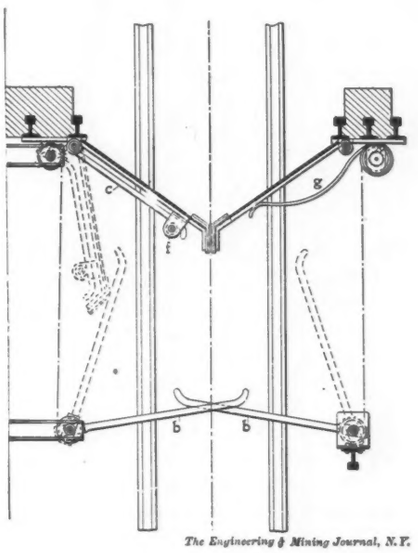
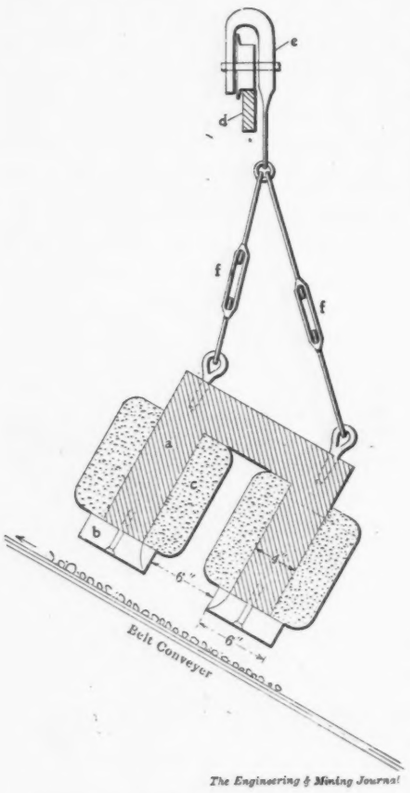


FIG. 2. SELF-ACTING MINE DOORS

Magnet for Removing Steel from Ore

The accompanying illustration shows the details of a magnet that is used by the Federal Lead Company, Flat River, Mo., to pick pieces of steel and iron out of the ore as it passes by belt conveyer from the crusher to the rolls. The metal to be removed consists of pieces of drill steel, bolts, track spikes and castings from the machine drills. In fact any iron



MAGNET FOR PICKING STEEL FROM ORE

that may get in the ore on its way from the stope to the mill.

The magnet used consists of a cast-iron part *a*, 4 in. thick, 20 in. high and 20 in. wide. It is wound with 19 layers of No. 10 double cotton-covered copper wire *c*, with 2300 turns on each pole. The current used is 5 amp. at 125 volts. The pole faces *b* are 2x6x24 in. and are spaced 6 in. apart. The magnet is suspended from a carriage *e* and supported on a track *d* at right angles to the belt. When a number of pieces of iron are collected on the magnet, the entire apparatus is moved to one side, the current cut off, and all the iron is dropped to the floor. The magnet is suspended 6 to 8 in. above the belt and is adjustable by means of turnbuckles *f*. This magnet will pick up pieces of steel weighing as much as 10 lb.; this prevents trouble and breakage at the rolls. A similar but smaller magnet is used by the Doe Run Lead Company.

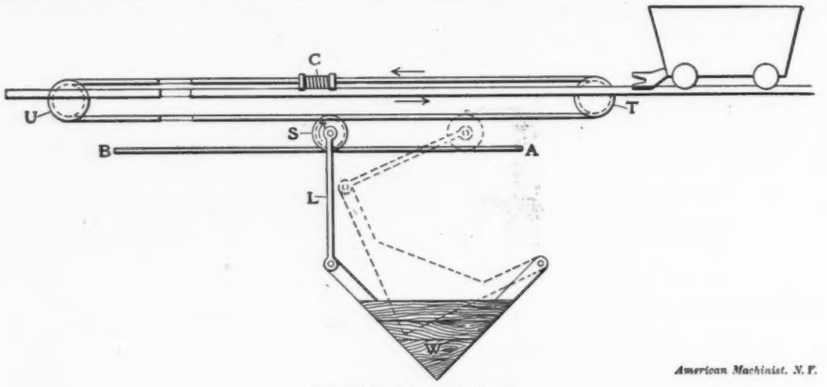
A Novel Car Dumper

A device that is used by the Hudson River Coal Company, at Delanson, N. Y., to transfer coal from its storage and mixing plant to the Delaware & Hudson Company's pockets for use in coaling locomotives, is described by Martin H. Ball in the *American Machinist*, Nov. 18, 1909. The mixing plant is about 300 ft. from the coal pockets and the track upon which the car runs is several feet higher at the mixer than at the coal end. The track is level at the point where the car stands while being loaded at the mixer by a two-ton bucket, which just fills the car. The latter is pushed by hand until it is at a point on the inclined track where it will run alone. Its speed, of course, increases as it runs down the inclined track and it is going at quite a high rate of speed when the picking-up piece on the forward end of the car strikes the clamp block *C*.

This clamp block has a piece at the left-hand end, as shown in the sketch, which is clamped solidly to the cable, and between this piece and the piece on the right, which is the one against which the car strikes, are springs which absorb a portion of the shock. The car goes on carrying the block before it until it raises the swinging weight *W*, as indicated by the dotted lines. The weight gradually brings the car to a stop at one of the pockets, the car having run against a tripping device just before stopping, which allows the side door of the car, hinged at the top, to open and drop its contents into the pockets.

As soon as the car is empty it is quickly started backward by the swinging weight pulling against it through the cable and clamp block. The clamp block now follows the car back considerably beyond the point where the car first picked it up, and oscillates until it finally stops at the point from which it first started, with the links *L* in a vertical position. Meanwhile the empty car has gone back up the inclined track to its starting point, it having received just enough push by the swinging weight to do this. The swinging weight is composed of a wood trough filled with concrete.

One end of the cable is fastened to the end *A* of the track upon which the sheave and wheels *S* run; then passes around the sheave *S*, runs off to the right, around the sheave *T*, thence to the left through the clamp block *C*, around the sheaves *U* and *S* and is finally fastened to the end of the track at *B*. When the car first strikes the clamp block the cable moves quite easily for two reasons: (1) The sheave *S* moves only half as fast as the clamp block, and (2) the links *L* which support the swinging weight are in a vertical position and can be moved by very little force from this central position. It, however, requires a rapidly increasing force to move it as it leaves this central position, so that in spite of the fact that the car strikes the block with a heavy blow, the shock is well taken care of and does not injure the parts. The clamp block is moved to different positions on the cable and the tripping device to different points on the track, to stop and unload the car at the desired pocket.



A NOVEL CAR DUMPER

Treatment of Zinc Sulphide Ores

In British patent No. 6511, of 1908, Woldemar Hommel describes the recovery of zinc, lead, silver, copper and gold from sulphide ores or products, the zinc in a metallic form as spelter, the other metals in a condition suitable for recovery by ordinary smelting methods.

The ore is roasted in a calcining furnace to eliminate the bulk of the sulphur that is in combination with the lead, zinc, iron or copper. The ore is then mixed with carbonaceous material, and zinc, together with some lead and silver products, is blown from it in the form of an oxide fume, which is condensed. The fume is made dense, mixed or briquetted with fuel and treated for reduction to spelter in a distillation furnace. The residue containing lead, silver and carbonaceous material is brought back and mixed with the roasted ore, thus saving the metals and supplying some of the necessary fuel. The process is controlled by the Metals Extraction Corporation, Ltd., of London.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

A. H. Wethey left New York Dec. 6 for Butte, Montana.

W. A. Clark went to Arizona Dec. 6 and will visit Montana before returning to New York.

The Merton Metallurgical Company, Ltd., has removed its offices to No. 3 Lombard street, London, E. C., England.

Peter B. Scotland, of the Arizona Copper Company, has returned to Clifton, Ariz., from a visit to the Mesabi and Vermillion ranges in Minnesota.

Victor G. Alderson, president of the State School of Mines at Golden, Colo., has been visiting the San Juan region in the interest of his institution.

B. O. Pickard, formerly superintendent of the Little Coronado mine in the Clifton-Morenci district, Arizona, has taken charge of mines at Gleason belonging to the Shannon Copper Company.

Clifford Wilfley is superintendent of the cyanide mill of the Virginia & Mexico Mine and Smelter Corporation at Hostotipaquillo, Jalisco, Mexico. He succeeds P. R. Whitman, who has resigned.

Thomas Bennet has resigned his position as mining engineer for the Atlantic Copper Mining Company, to take the post of superintendent of the Lake Copper Company in the Lake Superior district.

D. S. Calland, recently with the Pinguico Mining Company at Flores, is to be chief metallurgist of the Real del Monte Company at Pachuca, Mexico. Augustus MacDonald will succeed Mr. Calland at the Pinguico.

Walton Van Winkle, of the United States Geological Survey, is arranging for testing the waters of the Columbia river at various points. The work has been undertaken by the State of Washington in conjunction with the survey.

E. N. Funston, recently manager of El Cubo Mining Company at Guanajuato, is to be general superintendent of the Real del Monte mines at Pachuca, Mexico. His successor at El Cubo is F. G. Fabian, but it is said that this appointment is only temporary.

George S. Rice, mining engineer for the United States Geological Survey, met the operators of the McAlester district, Oklahoma, Dec. 5 and addressed them on the mine accident work. Plans were also inaugurated for a substation for rescue work in that district.

Robert DeLuce, manager of the Castle Dome silver and lead mines at Dome, Arizona, delivered an interesting lecture to the faculty and student body of the University of Arizona at Tucson, Nov. 22. The subject discussed was the "Liquid Assay of Gold."

C. A. Bohn, mining engineer, of Leadville, Colo., for the last eight years in Mexico, has entered the mining department of the American Smelting and Refining Company, and will be with S. W. Eccles, vice-president of the company in New York.

C. B. Lakenan, general manager of the Nevada Consolidated, Cumberland-Ely and Steptoe Valley Mining and Smelting companies, has been in New York for several weeks in consultation with other officials of those companies. He will return to Ely next week.

George W. Woodruff, judge of the United States Court at Honolulu, Hawaii, has just resigned this appointment to accept the secretaryship, in connection with duties of a legal-advisory character, of the Pocahontas Fuel Company and the Pocahontas Consolidated Collieries Company.

Judge E. H. Gary, chairman of the board of directors of the United States Steel Corporation is visiting the Birmingham district in Alabama to look over the properties of the Tennessee Coal, Iron and Railroad Company. The Chamber of Commerce of Birmingham will entertain Mr. Gary during his stay.

S. H. Ball, formerly of the United States Geological Survey and more recently in charge of prospecting for the Société Internationale Forestiere et Miniere du Congo, has opened an office as consulting mining geologist at 71 Broadway, New York. He is at present in New Mexico on professional work.

Dr. Eugene Haanel, Dominion Director of Mines, Ottawa, has been requested to recommend an electro-metallurgist capable of taking charge of the erection and management of an electric-smelting furnace to H. Boholm, of the Cobber Mine and Smelter Company, Trondhjem, Norway, where electric smelters are to be established.

James E. Chapman, who was for several years in Mexico for the American Smelters Securities Company and recently in the New York office, will go to Pachuca, Mexico, about Jan. 1 to join the staff of the Compañia Minera de Real del Monte y Pachuca, one of the subsidiary companies of the United States Smelting, Refining and Mining Company.

Obituary

The cable reports the death on Dec. 10 in England of Dr. Ludwig Mond, the eminent chemist, who is known all over the world. We hope to publish a fiitting account of Dr. Mond's life and services at an early date.

George Darsie McGrew died at Pittsburg, Penn., Oct. 8, aged 82 years. After an apprenticeship in banking, he entered into the coal business in 1860, operating several mines and shipping coal down the Ohio river. His firm was among the first to use steamboats to tow its coal barges to the Mississippi river towns as far as New Orleans. Later his activities were extended to the oil trade, as a well owner and producer. He retired from active business about 10 years ago.

William N. McGugin died at Olive Furnace, O., Dec. 7, aged 92 years. He was the oldest charcoal-iron maker in the country. He was born in Wooster, O., in 1817, and in 1846 removed to the Hanging Rock district and entered the iron business. After working at the old Marble and Gallia furnaces, he went to Olive furnace over 50 years ago. He gradually acquired a controlling interest, and in 1883 organized the McGugin Iron and Coal Company, of which he remained president until his death.

Societies and Technical Schools

Mexican Institute of Mining and Metallurgy—The excursion of this society to Pachuca in the last week in November was highly successful. There were 44 members in attendance, and two days were spent in visiting the mines and reduction works in and around Pachuca, under charge of a local committee. A business meeting of the institute was held, many important matters were discussed.

Western Association of Technical Chemists and Metallurgists—The board of control has decided to hold the fifth annual meeting of the association at Boulder, Golden and Denver, on Jan. 6, 7 and 8, 1910. It is planned to make this meeting especially interesting and profitable to our members, and it is hoped that many will avail themselves of the opportunities offered by the inspection trips arranged by the committee. These trips include beet-sugar factories, breweries, smelteries and various industrial plants. Opportunity will also be afforded for inspection of the various laboratories of the State University and of the School of Mines. The headquarters during this meeting will be the association rooms, 1510 Court place, Denver, Colorado.

Coal Operators' Secretaries' and Commissioners' Association—A meeting was held in Chicago, Dec. 1, at which general conditions in the various States and districts were discussed at length. It was resolved that hereafter meetings shall be held semi-annually, in June and December. It was resolved that the association indorses the call of President Elliott of the Southwestern Interstate Coal Operators' Association for a meeting of operators to consider a federation of coal operators; that the association believes such a federation entirely feasible, in accordance with views expressed in 1905. The following officers were elected: President, Thomas W. Davis, Michigan; vice-president, Philip H. Penna, Indiana; secretary, C. L. Scroggs, Illinois.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Butte, Denver, Salt Lake City, Goldfield, Cobalt and Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

Dec. 10—It is expected that the Merced group of quartz mines at Coulterville will shortly be reopened after many years of idleness. This group was at one time extensively worked with all suitable facilities. The mines and machinery have been, however, kept in very good condition, contrary to the usual custom, and it will require little expenditure to put the whole property in order for work again. A number of the other mines near Coulterville have of late been giving good accounts of themselves and this has encouraged the Merced company to undertake work again. Since the mines closed down the conditions have materially changed and operations may now be carried on at much less cost than formerly. What that section needs most is electric power as the fuel question has always been a serious one. It is probable that before many months electric power will be furnished for the district.

Another mine, once famous, but which has been closed down for about 30 years, is the Eureka at Sutter Creek, Amador county, owned by Mrs. Hetty Green, of New York. Her terms for sale have always been prohibitive and she would not bond the property. The mine closed by reason of a fire. Meantime other mines in that vicinity have proved very rich at depth. Engineers have been looking up conditions at the Eureka and it is thought that a sale will result. A Scotch company has nominal control but Mrs. Green is the principal stockholder.

The Bay State group, owned by the Amador Gold Mining Company near Plymouth, Amador county, near the boundary of Eldorado county, includes the Bay State, Venture and Rhetta claims. Some development work has been done on all these claims and there is a 10-stamp mill on the property. The company owns about 220 acres of mineral lands. The Eastern men interested have recently visited the property and have decided to increase the mill to 50 stamps and to do more development as well as to equip the mine with better machinery. H. G. Torrence is the superintendent. The money for the proposed improvements has been made immediately available.

P. A. Brangier, of Agnew, Santa Clara county, and his associates, of Los Angeles, have obtained options on the Antlered Crest, Blue Gravel Placer, and nineteen other contiguous placer claims on the Mooreville ridge in Plumas county, about four miles from La Porte. The claims extend from the Kohl diggings up the ridge to within two miles of the Bellevue, or Thistle Shaft property. It is supposed that the Bellevue channel extends down the Mooreville ridge where these bonded claims are situated. Some of the gravel in the Bellevue channel is of high grade. It is expected that those who have taken the options on these gravel claims will shortly begin developing them by the drifting method.

While the advent of the rainy season has driven the prospectors to the valleys from the Magalia ridge in Butte county, many going mines will continue work all winter. Most of the mines are working gravel though there are several quartz mines. The North Star company near Powellton has put in machinery including a small mill. The Steiffer property, lately in litigation, is awaiting the completion of its new power plant on the west branch of the Feather river before starting up again. The Gold Dyke Mining Company is working the old Matheson mine near Coutolenc and has a mill on the ground not yet installed. The Mammoth Channel company near Magalia has recently installed a complete plant of machinery. The Magalia Consolidated Company near Magalia is running a tunnel to tap its channel. The Butte-Magalia Consolidated Company has cleaned out its old workings and put in machinery so the mine is nearly ready for operation. The Cape Horn Mining Company now has plenty of water. The Cohn & Goodday mine near Magalia has its incline down to gravel but it has not reached bedrock yet. Water for power has been brought in and machinery supplied. The ridge has many good mines but until of late many of them have been idle. There is now a general resumption of mining in that section of the county.

There appears to be at present some unusual activity in the mines in the gravel-mining fields in Eldorado county. A great gravel channel extends through the county north and south with numerous branches extending laterally. Some mines have been operating on parts of this channel for years and now a number of new mines are being opened and developed.

Butte

Dec. 13—The annual report of State Mine Inspector William Walsh states that 15,000 men were employed in mining in Montana during the last year, and that in spite of the general financial depression throughout the country the mines have produced their usual output. Forty-seven fatalities occurred in the mines during the year, the greater number of which were caused by the carelessness of the miners themselves. The inspector comments upon the fact that at the recent session of the legislature several bills were put forward by the miners looking to the regulation of operations of the larger mines of the State, but that the legislature uniformly refused to consider any of these measures. A serious consideration of such measures is advocated for the purpose of improving the sanitary conditions under which the miners work. Comment is also made upon the fact that at the larger mines a number of accidents are indirectly due to the different points of view with which the shift bosses on the one hand and the foremen and superintendents on the other regard the operations. While the mine foremen and superintendents usually endeavor to use all due precautions with reference to proper timbering and other measures for safety of the men, the shift bosses, under whose personal supervision the men work, are actuated by a spirit of rivalry to see which can mine the greatest amount of ore during his shift and they frequently lose sight of the importance of proper timbering and the safety of the men working under them. While there are at present a number of laws in force in this State for the protection of those working in the mines, yet there is room for much additional legislation on the subject. Two years ago the legislature passed a law with reference to the location and acquisition of mining claims, and this law greatly simplified and improved the former law on the subject, and it would appear advisable that some such measure be taken with reference to the safe regulation of operating mines.

The strike of the railway switchmen shows no signs of ending. Of the roads running into Butte, the Great Northern and the Northern Pacific are seriously affected in their capacity to handle freight, such as coal and ore, but the Oregon Short Line, and the Butte, Anaconda & Pacific are carrying freight as usual. As a result, the Butte mines having ore bins on the Great Northern and Northern Pacific tracks have been forced to close since no ore cars can be obtained. This includes the Boston & Montana company's Mountain View, East Colusa, West Colusa, Leonard and Pennsylvania, and that company's smeltery at Great Falls, the Butte & Boston company's East Grey Rock, Silver Bow, and Berkeley, the Washoe company's Moonlight, the Parrott company's Parrott, the Coalition company's Tramway and the Anaconda company's Right Bower and

Belmont mines. The principal supply of coal for the Butte mines comes from the Diamondville mines in Wyoming, and since the Oregon Short Line is operating as usual, this supply is not interfered with. The uninterrupted operation of the Butte, Anaconda & Pacific road connecting Butte with the Washoe smeltery at Anaconda, enables that smeltery to treat the Butte ores as usual.

The United States assay office at Helena reports receipts for November at $175,304, as against $112,618 for the same month last year. Fergus county leads with $58,229.

A total of 106,570 shares of stock was traded in during the month of November on the Butte stock exchange, at a total price of $138,746. Alameda leads with 29,220 shares traded in and Butte & Superior was second with 21,375 shares.

The recent purchase of the Rochester ranch at Bearmouth, Mont., by W. A. Clark has led to the report that the senator intends to erect a smeltery at that point to treat ores from the mines in the adjoining Phillipsburg district. These ores are now shipped to smelteries at Butte and Anaconda at a considerable cost and a smeltery erected at Bearmouth would doubtless secure a considerable supply of custom ores. The range carries with it the right to 357 in. of water, sufficient for the purposes.

Denver

Dec. 12—Sir Moreton Frewen, the British silver champion, has been expounding his views to Denverites at the Chamber of Commerce dinner. The chief points he made were that within 18 months the British empire will put into effect the Goshen plan of the issuance of nonlegal-tender notes for 10 and 20s., secured by silver deposited in the government treasury, and that this will cause an immediate rise in the price of silver, to the great advantage of Colorado and other silver-producing States of the West. That gold prices have advanced at an unprecedented rate for the past 10 or 15 years, but as they are not accompanied by a corresponding rise in silver prices in Asia and the Orient, our industries are being swept off their feet one after the other, as proved by the fact that whereas when the price of silver was up, ships from our Pacific coast for the Orient were going out loaded with lumber, steel, leather and other bulky commodities, they now go out empty, and return loaded with goods that enter into competition with American wage earners. Asking the opinion of a Denver banker and financier for an expression on Sir Moreton Frewen's work here, his reply was: "The bankers of the West, and for that matter of the civilized world, have decided on gold as a stable and conservative medium of exchange, and that, therefore, it is pretty certain that the cause of silver is a forlorn hope." This was answered by a silver-mine owner, to whom I repeated it, with a laugh, and the words: "Why, of course; gold is the money of the rich, and silver of the poor, and as the bankers make more money out of the former, they naturally are all in favor of gold, but they can't stop silver coming back." These two opinions from leading men in what has been known as a silver-producing State, may in a concise manner give an idea of the present feeling here on this important subject.

The third annual banquet of the Golden Cycle Company, of Cripple Creek, occurred Dec. 1, and many speeches were made, the keynote of which was a desire for a railroad commission that would be a medium of protection between the shippers of ore and the railroads, which latter, it was maintained, are charging exorbitant rates of freight, and as they apparently owned the State legislature, could not be reached in that way. About 300 mining men from the district attended, and it was a great success.

Salt Lake City

Dec. 10—The Utah Ore Sampling Company has filed articles of incorporation in Salt Lake with a capital stock of $200,000, in $1 shares. The officials are Ernest R. Wooley, president and general manager, Jesse Knight, vice-president, J. William Knight, secretary and treasurer. These with W. Lester Mangum and F. R. Wooley comprise the directors. The new company has acquired all the sampling works in Utah except the McIntosh sampler at Park City which was already controlled by Wooley and associates. The Taylor & Brunton plants at Murray and at Tintic and the Pioneer sampler at Sandy which was controlled also by Wooley went into the consolidation. The cash consideration amounted to $200,000. Practically all the custom ores of Utah, Idaho, western Colorado, eastern Nevada and parts of Montana, California and Arizona pass through the Salt Lake samplers to the ore market. The combined plants have an annual capacity of about 500,000 tons and have regular contracts for about 300,000 tons. The original plant of the Pioneer sampler was built at Sandy, 13 miles south of Salt Lake City 40 years ago. During the last few years it has been completely remodeled. The Taylor & Brunton company entered the field in 1893 by building the Murray plant, a few miles south of Salt Lake City. Business increased to such proportions that last year a new sampler was built at Silver City in the Tintic district.

Hornblower & Weeks of Boston and New York have purchased a seat on the Salt Lake Mining and Stock Exchange.

Joplin

Dec. 12—November has shown an increase in activity all over the Joplin district. All the mines are running, and the total production for the month was 40,334,040 lb. of zinc ore and 5,026,530 lb. of lead, having a value of $1,116,595. While it was exceptionally rainy during the month, the total production, together with the base price, kept up with remarkable consistency. More activity among the buyers has been noticed and a great many mines and leases have changed hands. The greatest number of sales has been in the West Joplin sheet-ground district, and this camp is rapidly coming to the front. Six large modern mills are running, and as many more are to be built in the near future.

The Kansas camps produced for November 3,487,650 lb. of zinc and 302,470 lb. of lead, having a value of $95,467. Mining is showing great gains in the Galena and Empire camps, but no new prospects are being brought in from the Badger-Peacock camps. Galena is coming into an era of deep mining that will radically change the old methods there. The camp has been in the hands of the custom mills, and now more mills are being built all over the camp than for years. The operators are awaking to the fact that where shallow ore exists deeper ore is almost sure to be found. In both ends of the camp large deposits of disseminated ore have been found below the Grand Falls chert or sheet-ground horizon.

The total production for November in the Oklahoma camps amounted to 2,300,030 lb. of zinc and 431,560 lb. of lead, having a value of $64,414. The mines in the Miami camp do not show the activity that they should as the extension of the limits of the camp is slower than was anticipated. The two tailing mills are making good records, showing that the loss in the tailings has been great. The Okmulgee has the best prospect of the new mines. The development of the deeper runs progresses slowly, but is anxiously awaited as it means a great deal to this camp. The high royalty is retarding development to a great extent. In the Baxter-Quapaw camp more life is shown than for two years. With the present high prices the low-grade mines of this camp can be worked with profit, and all the mills are running or preparing to run and the production has increased rapidly.

Scranton

Dec. 11—Over 500 miners working in the collieries of Lackawanna county had their certificates cancelled immediately after the investigation conducted by the county authorities after the exposure of the traffic in miners' certificates. Undoubtedly this was a great hardship to a number of miners who, although their certificates were illegally issued, yet obtained them in good faith. Of course the number of those who were absolutely unaware that they had become possessed of illegal certificates was comparatively small. According to the laws of Pennsylvania, the mine examining boards can sit only upon three days each month, and for a limited number of hours each day. The consequence is that there are about 400 miners idle because they cannot secure

certificates which they are fully competent to hold.

The Scranton Board of Trade forwarded a communication to the presidents of the companies owning coal properties in the neighborhood of this city asking them to send representatives of their companies to a conference with that body in order to adopt some plan to prevent subsidences in excavated coal areas. President Underwood of the Erie, replied that he saw no good in such a conference. President Fowler of the Ontario & Western sent a communication to the same effect. President Loree, of the Delaware & Hudson, answered that if such a conference were held, that he would have his company represented; while President Truesdale, of the Lackawanna, requested the board to outline for him the scope that the deliberations of such a conference would take, in order to be in a position to consider the proposal as it might affect his company and the people immediately interested. The Board of Trade has sent a reply to President Truesdale's request outlining the heads of a discussion, which they believe would lead to some practical results.

The Lackawanna Coal Company is sinking two shafts at Dundee, near Wilkes-Barre. When the shafts are sunk, the company will erect a breaker at the place with a capacity of 2500 tons, which it is expected will give employment to 1200 men when in full operation. The new workings will be driven 920 ft., to reach the Hillman vein. Later on several other veins will be opened.

Indianapolis

Dec. 12—President Lewis, of the United Mine Workers of America, has issued a formal statement in which he commits the organization in favor of a national bureau of mines.

The ballots for the election of president and other officers of the United Mine Workers of America have been sent out to the local organizations from headquarters in Indianapolis. The race for the presidency is being made by T. L. Lewis, present incumbent, and William Green, of Ohio. Each candidate is making a personal canvass of the districts. John H. Walker, of Illinois, who was a candidate against Lewis last year, is managing Green's canvass, and considerable bitterness is being injected into the campaign.

Cobalt

Dec. 12—Little is being heard of the Gillies Limit claims, and many of those who bought lots at the last sale are beginning to regret the extravagant prices paid. Their value, however, cannot be estimated until more work has been done and the delay in getting air and electricity from the power companies is responsible to a large extent for the small amount of work. The owners feel that it would be unwise to go to the expense of installing plants until the cheap power is available. The Hydraulic Compressed Air Company has promised air for the middle of January; it is very doubtful if it will be ready for delivery before a month or more from that time. This power will have a beneficial effect on the camp and many properties now lying idle will start work as soon as cheap power can be procured. Several of the mills are also awaiting the electric power and their capacity will be much increased when it is available.

Considering the revival of interest in gold mining in northern Ontario, it is interesting to note that for the year 1908 only 3465 oz. of gold were produced. When the gold mines in this section of the province are firmly established the output should be largely augmented. The first place in which gold was discovered in this district was at Larder lake, and although uptodate, the results have not been very encouraging, work is going ahead, and if the properties are properly developed and conservatively managed, they stand a chance of eventually making good. Gold was next discovered in Munroe township, and subsequent to that at Painkiller lake. Several companies are operating in the latter section and good results are being obtained. It is probable that this winter a small mill will be erected by the Painkiller Lake Gold Mining Company. This company started its shaft on an 8-in. vein and at a depth of 50 ft. the vein had widened to over 4 ft. The latest district to claim attention is around Porcupine lake, where gold was discovered this fall. A large number of prospectors have already gone into the district, but the real rush will not take place until the winter roads are in shape and extensive preparations have been made to handle it. At the present time a large number of dog teams and horses are waiting at Matheson, and their numbers are being increased daily, while large quantities of supplies are being obtained in readiness for the time when the roads will be fit to travel over. A large amount of work will be done this season, and until such time as that is accomplished it will be impossible to give any estimate of the value of the discoveries.

During the past week seven new mining companies with a total capitalization of over $7,000,000 were incorporated.

Toronto

Dec. 11—A statement has been issued by the Ontario Bureau of Mines, showing the output of the metalliferous mines and works of the province for the nine months ended Sept. 30, as follows:

	Quantity.	Value.
Gold, oz.	1,125	$18,926
Silver, oz.	18,751,549	9,385,600
Cobalt, tons	427	79,450
Arsenic, tons	780	39,221
Copper, tons	5,583	740,677
Nickel, tons	8,912	1,921,363
Iron ore, tons	205,262	473,770
Pig iron, tons	294,698	4,095,735
Zinc ore, tons	785	8,000

The gross production amounted in value to $16,762,742, against $12,185,511 for the first nine months of 1908. Cobalt ore shipments amounted to 22,218 tons, of which 1878 tons were concentrates, the total silver content exceeding that of the same period last year by 6,170,039 oz. The output of nickel showed an increase of 1162 tons, iron ore 39,174 tons, and pig iron 105,411 tons, while copper showed a decrease of 309 tons.

Count Alfred Von Hammerstein, on Dec. 3, testified before the committee of the Canadian senate on mineral resources at Ottawa, concerning the richness of the Athabasca oilfields. He stated that for eight years he had been engaged in the exploration of a field between 320 and 350 miles north of Edmonton. He and those associated with him in the work had spent about $85,000 and drilled 14 wells scattered over an area of 60 miles. The wells varied in depth from 250 to 1200 ft., and some of these had revealed the presence of oil and gas in large quantities. He produced samples of sand impregnated with oil which he ignited before the committee, and stated that there were inexhaustible supplies of this material in the region. It was found in a hardened state near the surface but at the depth of 60 ft. it occurred, he stated, in a semi-liquid condition. He was satisfied that deep drilling would result in a large production of oil.

Mexico

Dec. 12—The mining operators in Mexico generally believe that the mining interests were made to suffer by reason of the adoption of the gold standard, at the expense of the railroads and other interests in the country, chiefly those in which foreign capital was largely invested. In this connection the following report from the Mexican Exchange and Currency Commission, recently made to Señor Limantour, minister of finance, is of interest: "The silver-mining interest still complains of the abolition of its time-honored right of free coinage, which was nothing but a privilege by virtue of which all the inhabitants of the nation had to buy the product at a fixed price and at the cost of an actual decline in salaries and wages, though in appearance they might seem to rise, and of a depreciation as unjust as it was general in every branch of public and private wealth. The mining interest in thus complaining forgets that under the new regime it alone profited, as indeed was only fair, when the price of silver rose, selling it, not at the old coinage value of the metal, which was $40.91 per kilogram, but at $43 and even more; it also forgets the permanent reduction in taxes decreed in its favor when the monetary reform came into force and that it also derives advantages from the fixity of exchange when it makes purchases abroad of machinery, tools, apparatus, and many other articles which it needs in the development of its industry."

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Calumet & Arizona—The smeltery output for November was 4,500,000 lb. from four furnaces and five converters.

GILA COUNTY

National Mining Exploration Company—This Boston company is developing adjoining the Arizona Commercial property at Globe. The Williams shaft is down 350 ft. and it is expected will cut the vein, opened at 500 ft. in the Eureka shaft of the Commercial company. About 800 ft. of work has been done on the Black Hawk vein of the Iron Cap claim. F. A. Woodward is in charge.

Old Dominion—The November production was 2,296,000 lb. of blister copper.

GRAHAM COUNTY

Arizona Copper—The November output was 1,614,000 lb. of copper.

PIMA COUNTY

Twin Buttes—The company has about 60 claims 27 miles southwest of Tucson. The mine is connected with Tucson by the Twin Buttes railroad, which the company built and which has recently been taken over by the Southern Pacific company. This road is now being extended to Nogales and may be made the main line into Mexico from the west. The Twin Buttes company has been shipping for about two years, and during that time has taken up and paid a bonded indebtedness of about $90,000 and has $20,000 in the treasury. The surface equipment from the Morgan shaft has been removed to the new working shaft, which has been upraised from the 400-ft. level, and the company has resumed shipment. A contest is on for the control of the board of directors to be elected at the meeting Jan. 18. There are five other properties developing in the Twin Buttes district.

Helvetia—This company is carrying on extensive developments during the suspension of shipments. During the last year, ended June 30, 1909, 5327 ft. of development work was accomplished at an average cost of $20.46 per ft. including all general expenses and depreciations. C. C. Prindle is president.

Wayne Development—The company has made the first payment on the properties in the Comababi mountains to Edward Rochester and is planning to develop actively. A new gold strike was recently made adjoining the property and is now being explored.

MOHAVE

Wallapai Mining and Development—This company, owning the Tennessee mine at Chloride, is planning to resume. The company has not decided whether it will treat the zinc-lead ore at the mine or sell it crude. James H. Hurin, of Los Angeles, is president.

YAVAPAI COUNTY

Vulture—The company has added a compressor and five drills and is carrying on development work to increase the ore reserves. Twenty stamps are now running and a new mill is being built—using 1500-lb. stamps. A cyanide plant is planned. The property was taken over by the present company in September, 1908, and since that time has carried on an active development campaign.

Golden Ridge—This property, seven miles east of Congress Junction, has reported a gold strike. The Southern Yavapai company, T. J. Morrison, in charge, is developing another gold property near the Golden Ridge.

Black Hills Copper Company—The property is 12 miles south of Jerome on the eastern slope of the Black Hills range. The main shaft is 400 ft. deep, with 1500 ft. of workings. Some copper ore has been encountered, but not in commercial quantities. The company is controlled in Pittsburg.

California

AMADOR COUNTY

Kennedy—In this mine at Jackson a new level is being opened at the 3300 station where the vein was met recently. The 100-stamp mill continues to crush 400 tons of ore daily. The company is planning to increase its mill by 50 stamps.

BUTTE COUNTY

St. Francis—Joseph A. Dowling has been elected president of this company. The 10-stamp mill will be running next month. The mine has been equipped with compressor and auxiliary gasolene engine. The Mooretown ditch has been purchased and will furnish water for power. John McCarthy is superintendent.

CALAVERAS COUNTY

Tulloch—Thomas Ewing is sinking a two-compartment shaft on this mine near Angels and the old mill on the property will be repaired.

Dolling—Work of sinking a shaft on this property at Angels has commenced. This was formerly the North Star mine and adjoins the Gold Cliff on the west. A 40-stamp mill will be built.

ELDORADO COUNTY

Clark—At this mine, four miles from Shingle springs, a 10-stamp mill and gasolene engines are being installed. Randall & Blake, of Sacramento, have the bond.

SONOMA COUNTY

Culver-Baer—The furnace at the Sonoma mine will be purchased and placed on this quicksilver mine.

Eagle-Shawmut—The new shaft has been started at this mine at Chinese and the hoisting machinery will be moved from the old shaft.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

Ophir-Burroughs—A. Watters & Co., of Bald Mountain, have taken a lease on this property and commenced shipments.

Gladstone—This property in the Lake and Illinois-Central districts, has been leased and bonded to W. H. MacFarland, Toledo, O., for three years in the sum of $25,000, and active developments have been started.

Sea Bird Mining Company—This company has purchased the group in Moon gulch for $7500, and will install a compressor. H. Everest, Rollinsville, is superintendent.

TELLER COUNTY—CRIPPLE CREEK

Jerry Johnson—The November output from the properties of this company, on Ironclad hill, was 52 cars of shipping ore, and 1000 tons of low-grade, treated at the mill on the property, having approximately a gross bullion value of $46,000. A dividend will be paid Dec. 15 of 1c. per share, amounting to $25,000.

Doctor-Jack Pot—The quarterly report from July 1 to Oct. 1, mailed to the stockholders, along with a dividend of ½c. per share, amounting to $14,500, shows royalties received from lessees $4300, and a cash balance in the treasury of $40,800.

Gold Dollar Consolidated—The royalties for August were $2075; September, $2068; October, $2000, with a cash balance in the treasury of $13,244.

Prince Albert—The production during November is given at 600 tons, of a gross value of $9000.

El Paso Consolidated—The November production from this property on Beacon hill, by leasers, was 101 cars, approximately 2500 tons of ore, the value being given at an average of 1 oz. gold per ton.

Western Investment—This company, which is operating the Mary McKinney mine under lease, is said to have made a production during November of nearly 800 tons, yielding $30 per ton.

Last Dollar—This mine, credited with a production of $2,000,000, but which has been idle since 1904, has been leased for 18 months to responsible parties, and will be put in active operation at once. The main shaft is 1278 ft. deep, with 12,000 ft. of drifts and crosscuts. It is fully equipped with powerful machinery.

Granite—This property on Battle mountain is stated to be making a production of 2100 tons per month.

United Gold—During November, under the leasing system, this company shipped 2500 tons from dump and mine, the average value being given at $30 per ton. Twenty sets of leasers are employed on the various mines of the company, viz.: Wild Horse, Damon, Deadwood, Trail, W. P. H., Montrose, Midway and Trachyte. A dividend amounting to $40,000 will be paid Dec. 20.

School Section—This company, leasing on block 8, School Section No. 16, at the base of Bull hill, has opened a new orebody at the third level. The ore is about 6 ft. wide, and can be hand-sorted to run about $20 in gold, with shipments of about 75 tons per week.

Michigan

Copper

The output of copper for November by the Calumet & Hecla Mining Company amounted to 6,470,473 lb., compared with 6,670,899 lb. for October. The subsidiary companies report the production for November: Ahmeek 1,112,695 lb.; Osceola, 2,050,110; Tamarack, 1,232,715; Isle Royale, 629,210; Centennial, 214,219; Allouez, 345,956 lb. The Superior Copper Company purchased 212,710 lb. in November.

Hancock—No. 2 shaft has reached the footwall of No. 3 lode in one corner. The lode at this point is 15 ft. wide. No. 2 shaft will continue on its way to cut the Pewabic lode, estimated to be about 1500 ft. further down.

Gratiot—No. 1 shaft is sinking below the 11th level, with drifting under way at all the levels above. No. 2 shaft is down to the 12th level and is drifting from the 9th, 10th, 11th and 12th, the ground down to the 9th level being somewhat disappointing. This company has a stock pile of 15,000 tons.

Montana

Butte District

Butte & Superior—A contract has been entered into whereby the mining company will send all its ore to the concentrator at Basin for treatment until the Butte & Superior zinc mill is completed. A spur is being constructed from the mine to the Great Northern tracks and shipments will start by Jan. 1. The crosscut south on the 1600-ft. level is being cut through the second vein.

Amalgamated—The raise from the 1100-ft. level of the East Grey Rock mine to connect with the 700-ft. shaft of the West Grey Rock, has been completed making the shaft of the latter mine 1100 ft. deep. Stations have also been cut on the 850-, 1000- and 1100-ft. levels. The West Grey Rock is now hoisting about 125 tons daily while the East Grey Rock was hoisting 600 tons before it shut down on account of the switchmen's strike. Previous to the shut-down the Silver Bow was hoisting about 350 tons daily.

Jefferson County

Boston & Alta—The shaft has reached 300 ft. where a station is being cut from which a crosscut will be run to the Alta lead. Sinking will continue uninterrupted.

Corbin Copper—The Dewey tunnel is in 600 ft. and has encountered ore. The Dow tunnel is in 636 ft. Development work is being carried on at five different points. General Manager Richards has gone east for the purpose of making arrangements for the erection of a concentrator.

Wickes-Corbin—The crosscut tunnel is now in 900 ft. and has cut seven different veins.

Copperfield—A tunnel has been run on the vein 500 ft. and is in ore carrying copper and silver.

Montana-Corbin—Drifting on the 235-ft. level will be begun at once.

Peacock and Turkey—James Madden and A. C. Ray have secured a lease and bond for $20,000 on these claims in the Elkhorn district.

Nevada

Douglas County

Willard McDonald—This mine, near the Mountain House, has been bonded to Sheridan parties.

Esmeralda County

Ideal—This new company purchased the Knight-Condlon mill at Rawhide, and will add 10 stamps and do custom work.

Combination-Fraction—The company has secured a renewal of the lease of the mill of the Nevada-Goldfield Reduction Works and within a few days the stamps will again be dropping on company ore.

Goldfield-Florence Extension—An application for an order to make an underground survey of the workings, has been made by the Florence Goldfield Mining Company.

Humboldt County

Nevada-Swiss Smelting Company—This company is incorporated to acquire the Arizona and Henning groups at Unionville and is considering the installation of a small smelting plant. J. K. Mulkey is secretary of the company.

Lander County

Austin-Manhattan—This company is erecting a mill at Austin. It has developed milling ore in the Frost shaft on the Panamint vein and in the Jack Pot mine.

Lincoln County

Dinosaurus—The properties of this company, in Eldorado cañon, have been leased to a Denver company.

Nye County

The estimated value of the production from Tonopah for the week ended Dec. 4 is $125,700, the tonnage being divided among the various properties as follows: Tonopah, 3500; Montana-Tonopah, 968; McNamara, 300; West End Consolidated, 160; Midway, 100; total, 5028 tons.

Tonopah—This company is maintaining production of from 3000 to 3500 tons per week, most of the ore coming from the Mizpah and Valley View veins. The ore continues to be of an even grade and runs about $19 per ton. The company has been doing prospecting of late, and the last few weeks have shown 500 to 600 ft. of new ground broken, several new oreshoots having been disclosed.

Tonopah Extension—Practically all the machinery for the new mill has been received, and it is the intention of the management to start within the next 30 days. Underground work in the mine has begun and the cleaning up after a shut-down of several months is in progress. Several raises are to be run from the 35-ft. level to a point under the ore dump, and the ore will be dropped to that level and then hoisted through the main shaft and run through the crusher close to the collar.

Tonopah-Belmont—After a shut-down of one month the Belmont has again resumed. The main shaft has been repaired, and a number of surface improvements have been made. Underground work has been resumed and a full force of men is employed. Among the improvements is a Crane washer and ore picker and by the use of this device the manager expects to raise the grade of the ore. S. H. Brady is superintendent.

Storey County

C & C—Progress is being made in unwatering the shaft, the water now standing at 148 ft. below the 2350 station.

Ward—This shaft is holding the water and making necessary repairs to the shaft. A set of bearers was completed at the 2250 mark. Work is being pushed on the 2100 pump station.

Savage—This mine is shipping ore to the Franklin Leonard mill at the mouth of the Sutro tunnel.

Yellow Jacket—Work will be confined to the opening of the incline shaft to water level, stoping operations having been suspended.

Coleman and Chart—These claims on Cedar hill have been leased.

Baker—This mine is drifting west on a 5-ft. foot vein carrying good ore. The electric hoist on the tunnel level is in operation.

WHITE PINE COUNTY

Boston Ely—An assessment of 50c. per share has been called, payable Dec. 23. The Emma shaft is now 1065 ft. deep. During October the advance was 71 ft. and in November 35 ft. The November work was in particularly hard rock. The new compressor is in operation and increased speed in sinking is expected. It is figured that the water level will be reached at 1160 ft. The superintendent reports that carbonate ore was struck in the shaft Dec. 9.

Ohio

Sunday Creek Company—A suit brought in Perry county is pending to annul the charter of this company on the grounds (1) that the Sunday Creek Company, by permitting its stock to be held unlawfully by the Hocking Valley Railway Company has abdicated the powers conferred upon it by the State of Ohio, and is, therefore, divested of its authority, and (2) that by holding the stocks of kindred and competing corporations it is violating the law of Ohio. The company is a holding company, organized to hold and operate the coal mines formerly owned by the Hocking Valley Railway Company. It is the largest coal company in Ohio, practically controlling the Hocking Valley district.

Oregon

JACKSON COUNTY

Murray—S. H. Murray, of Central Point, has bonded the mine to M. O. Womack, who will erect a 10-stamp mill.

JOSEPHINE COUNTY

Oregon-California—This property has installed hydraulic equipment at the former Biggs property, and plans are being made to erect a mill. George W. Soranson, Grants Pass, has charge.

Pennsylvania

ANTHRACITE COAL

Knickerbocker—A mile of track has been built to carry coal from this colliery, near Shenandoah, to the Ellengowan breaker. Work which was stopped by the burning of the breaker on Nov. 20, was resumed Dec. 10 in the colliery.

Nay Aug Coal Company—The breaker at Dunmore was burned Dec. 3, the loss being a total one. It is to be rebuilt at once.

Vulcan—This colliery and the Buck Mountain, both on Broad mountain, east of Frackville, will be taken over and operated by the Lehigh Valley Coal Company on Jan. 1 next.

BITUMINOUS COAL

J. V. Thompson, of Uniontown, has closed a sale of a field of 3000 acres of the Pittsburg vein of coking coal in Greene county, to William G. Mather, of Cleveland, O., for $1,750,000. Mr. Mather is president of the Cleveland-Cliffs Iron Company.

Sackett Coke Company—This company has bought the Madison plant of the United-Connellsville Coke Company, in Westmoreland county, for $125,000. The plant is on the Hempfield branch, nine miles southwest of Greensburg, and comprises 45 acres of coal. The plant consists of 50 ovens constructed about three years ago.

Utah

BEAVER COUNTY

Beaver Carbonate—On the 700-ft. level, an orebody has been developed 30x100 ft. and a second orebody of milling grade has been developed, 75x100 ft. These orebodies are said to warrant the building of a mill. M. M. Johnson is consulting engineer; Grant Snyder, manager.

Leonora—A contract for another 100 ft. has been let on the tunnel already 400 ft. long. More active development has been stimulated by the finding of the shipping ore on the Red Warrior adjoining.

Horn Silver—Plans are being worked out for a concentrating mill for the separation and saving of the various minerals in the complex ores. The present price of zinc justifies the shipping of the zinc but these ores carry also 10 per cent. lead and 5 oz. silver for which the zinc smelters do not pay. A mill to accomplish the separation and saving is to be built. The mine was maintaining an average shipment of 1500 tons per month to the Knight smeltery when it closed down. Efforts are being made to secure another smelting contract. At present the company is delivering 1000 tons of zinc ore to Colorado, on contract. The mine has a dividend record of $6,000,000.

Red Warrior—A streak of rich galena has been encountered on the 400-ft. level underneath the sand carbonates which have been furnishing the shipping ore from the mine.

CARBON COUNTY

Utah Fuel—Contracts are being let for a tunnel 8000 ft. long to convey water from Ranch creek to the mines at Sunnyside. The estimated cost is from $8 to $10 per foot.

JUAB COUNTY—TINTIC DISTRICT

Lower Mammoth—The station on the 200-ft. level has been completed and drifting has begun for the ore which occurs in the upper levels. It is expected that two months will be required to drive this drift to the ore.

Mammoth—The judgment in favor of the Grand Central has been paid to the amount of about $150,000; the final payment will be made Jan. 12, bringing the total to $176,385.

Sioux Consolidated—The ore on the 450-ft. level is showing up well and although it is not so good as on the 400 is nevertheless of shipping grade.

Grand Central—A dividend will be paid during December but it is not stated whether this will be the inauguration of regular dividends. The treasury has been put in exceptionally strong position by the heavy payments from the Mammoth company.

Golden Chain—The company has taken complete charge of the workings of the Ajex recently acquired. Drifting for the Golden Chain oreshoot is under way on the 300- and 1100-ft. levels.

Uncle Sam Consolidated—An entirely new strike has been made which is farther west than any ore previously encountered. The oreshoot is 7 ft. wide.

SALT LAKE COUNTY

Ohio—In the Elvina vein a second seam of rich ore, first encountered on the 100-ft. level has been cut on the 500 where it is 4½ ft. wide and averages 4 per cent. copper, $1.80 in gold and is high in iron. The porphyry ores which are going to the mill, average only 1.75 per cent. copper. The first unit of the new mill, just started, is running satisfactorily, treating nearly 700 tons per day.

Columbus Consolidated—The new orebody encountered on the 100-ft. level and for which a drift is being run on the 400, averages 10 per cent. copper, 15 per cent. lead and 18 oz. silver.

UTAH COUNTY—AMERICAN FORK DISTRICT

Mineral Flat—Work has been stopped and the property closed down indefinitely. The recent assessment will pay the indebtedness. Good ore was encountered in the upper levels and an expensive power plant was built and a long tunnel driven with the expectation of getting the ore in quantity with depth. The tunnel has not thus far encountered the ore and the company being without funds, the mine was forced to close. This is one of the Jesse Knight properties.

West Virginia

MARION COUNTY

Pittsburg-Buffalo Coal Company—This company has bought a tract of 2450 acres of coal land in the Brackenville section of the Fairmont district. The price is said to have been $290 per acre. Mines will be opened on the tract at once. The operations will be supplementary to those of the company in the Pittsburg district; and it is understood that the coal will go chiefly to the northwestern trade.

Wyoming

The Federal Circuit Court of Appeals has given an opinion setting aside the verdict and ordering a new trial in the case of the United States against the Union Pacific Coal Company, the Union Pacific railway, the Oregon Short Line railway, James M. Moore and Everett Buckingham, in which they are charged with having violated the Sherman anti-trust law, by forming an unlawful com-

bination. Proceedings were started by a Salt Lake City coal dealer named Sharp, who charged the coal company and the defendant railways with having refused to sell and haul coal for him. The Court of Appeals holds that the evidence of a combination was insufficient and orders a new trial.

Canada

British Columbia

Granby—A week's run at the smeltery at Boundary, gave an average of 560 tons of ore per diem smelted in seven blast furnaces. The eighth enlarged furnace had not yet been blown in. Operations have proved that the capacity has been increased to about 4500 tons each 24 hours, with eight furnaces running.

Consolidated—The orebody on the ninth level of the War Eagle mine, Center Star group, Rossland, continues to show up well. Ore is being mined on the sixth level of the Iron Mask mine.

Silver Cup—A larger hoist has been installed in the lower tunnel to facilitate sinking the winze below that level another 100 ft., to 1000 ft. F. Charles Merry, Ferguson, is superintendent.

Winslow—A 5-stamp experimental mill is being installed. D. E. Wert, Trout Lake, is superintendent.

Ontario—Cobalt

The shipments for the week ended Dec. 3 are as follows: Nipissing, 197,344; La Rose, 124,021; Trethewey, 127,500; Right-of-Way, 127,265; Hudson Bay, 120,735; Drummond, 100,000; Kerr Lake, 126,740; Crown Reserve, 123,900; O'Brien, 64,500; Buffalo, 53,300; Coniagas, 62,958; City of Cobalt, 63,480; Townsite, 54,369; Cobalt Central, 40,820; total, 1,386,932 pounds.

Crown Reserve—A rich oreshoot has been struck in No. 14 vein.

Nova Scotia—At the annual meeting held in Montreal, Dec. 6, the financial statement submitted showed $121,000 as having been expended on underground development and over $50,000 on surface work. The engineer's report showed 1,600,000 oz. of silver blocked out which was expected to return the first year some $60,000. A cyanide and amalgamating mill is under construction, which is expected to be ready early in the spring. The shareholders ratified the proposal to increase the capital stock by $500,000. The new stock will be offered to shareholders at 50c. per share *pro rata* to their holdings at one to every four held.

Ophir—At the annual meeting held at Cobalt, Dec. 6, a statement was presented showing over $116,000 in hand. Since the installation of the plant in June, 1000 ft. of stripping has been done, resulting in the discovery of four well mineralized veins. Shaft No. 1 is down 210 ft., and about 90 ft. of drifting has been done on the 100- and 200-ft. levels.

La Rose—Development on the No. 5 vein of the Lawson at the 88-ft. level has shown high-grade ore.

Ontario

Lake Superior Corporation—Contracts have been closed for the erection at the Sault Ste. Marie of 110 Koppers by-product coke ovens, to be completed by the close of 1910. The work will be under charge of Louis Wilputte, engineer for the H. Koppers Company.

Mexico

Baja California

Boleo—The November output was 1132 long tons of copper. The average ore yield was 3.89 per cent.

Chihuahua

Batopilas—The bullion shipment for November was 90,000 oz. of silver; for October, 49,600 ounces.

El Rayo—This mine at Santa Barbara has declared its first dividend of 3 per cent., payable Dec. 24.

Jalisco

Tecalitlan—A 20-ton Bryan amalgamating plant is nearing completion at mines owned by A. J. Stewart and G. S. Johnson in the Tecalitlan district. The mines have been under development for several years. The ore is free milling gold.

Amparo—It is hoped to secure water for milling as a result of sinking the 3-compartment shaft 300 ft. The present water supply is inadequate. Work on the shaft extension, which will give a depth of 1050 ft., has commenced.

Solomon and Hundido—The option on these Hostotipaquillo district mines, secured to allow an examination by the Bradbury interests of Los Angeles, has expired. No deal was made.

Mexico

El Oro—In November, mill No. 1 ran 20 days and mill No. 2 29 days. Crushed 25,456 tons; yielding bullion, $219,480. Working expenses were $115,190; expenditure on development, $28,000; profit, $76,290; profit on railway, $6000; total profit, $82,290; expenditure on permanent improvements, $5000.

Mexico Mines—Mill ran 29 days; crushed 11,050 tons; yielding bullion, $106,730; working expenses, $40,600; expenditure on development, $12,300; profit, $53,830. Net value of 50 tons shipped during month not included in the above profit, $12,000; expenditure on permanent improvements, $1000.

Oaxaca

Llave—The Boston company owning this property near Parian is installing a 10-ton mill to treat the gold ore from the property. Samuel Webster is manager.

Sonora

Moctezuma-Arizpe—Shareholders have subscribed 50,000 shares at $5 per share among themselves. A resumption of development work on the first of the year has been announced.

Lampazos—Eastern men are negotiating for this property. The Banco de Sonora is the present owner through indebtedness.

Amargoso—This mine, located 30 miles east of Calabazas station on the Nacozari railroad, is arranging to export ore. George J. Cole is superintendent.

Transvaal—Diamond drilling is being extensively carried on. A resumption of ore extraction will not be accomplished until the railroad reaches the property.

Tepic

The Southern Pacific line is being inspected preparatory to its opening as far as Rosamorada. An extensive mining section is tributary to that point.

Zapopan—Power and pumping equipment has been purchased, and some of the old workings will be unwatered preparatory to important development work. Later the cyanide plant will be modernized and enlarged. The mines are in the La Yesca district.

Independencia—The old Independencia mine 16 miles from the Pacific coast has been acquired by R. N. Leggett and E. C. Good.

Africa

Transvaal

The cable reports the gold production in November at 597,765 oz. fine, or slightly less than in October. For the 11 months ended Nov. 30 the total gold production was $132,163,443 in 1908, and $137,983,722 in 1909; an increase of $5,820,279 this year.

Central America

Salvador

Gigante Mining Company—Douglas Waterman and M. Milner are developing this property six miles from the Butter's Salvador and are installing a cyanide plant. The ore is partially free milling and averages $11 per ton. William Hollister is engineer.

South America

British Guiana

Aremu Mining Company—This company is developing a gold quartz property in British Guiana. A mill is under construction, and it is announced that it will be in operation by March 1. The same interests also have the South American Gold Company, operating a placer property in the same region. Gaylord Wilshire is president of both companies.

Peru

A concession has been granted to Julio Federico Galvez, granting permission to explore the River Tumbes, in the northern part of Peru for auriferous deposits. The area extends between Rica-Playa and Punyango, 60 kilometers.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Dec. 15—Coal trade in the West has been livened up by very cold and stormy weather, which has brought about extensive buying of domestic coals. Mines are fully occupied in filling orders and there has been an advance in prices at some of the principal distributing centers. Steam-coal trade continues steady. There is some complaint of shortage of cars, but conditions in this respect are much better than in the East.

The Seaboard bituminous trade shows little change. Business continues on a fair scale, but prices do not advance on account of the large supplies ready to be put on the market. Car shortage is still an element in the trade.

The anthracite trade has been suffering a good deal from the results of the long drought. Last week several large collieries were compelled to close down on account of lack of water. This week, however, there have been very heavy rains throughout eastern Pennsylvania, which will probably furnish a supply.

Southern Coal Rates—A number of coal operators in the southwestern section of Virginia met at Bristol, Tenn., and appointed a committee to contest the application made by Tennessee coal producers to the Interstate Commerce Commission for lower rates over the Southern railway. The Virginia operators claim that such rates would be differential and unfair to Virginia coal.

Coal Traffic Notes

Coal tonnage originating on the Southern Railway for the nine months ended Sept. 30 was: Tennessee district, 948,476; Alabama district, 1,754,507; total, 2,702,983 short tons. The total in 1908 was 1,992,168 tons, showing an increase of 710,815 tons, or 35.7 per cent., this year.

Coal and coke tonnage of the Chesapeake & Ohio railway, four months of fiscal year from July 1 to Oct. 31, short tons:

	Coal.	Coke.	Total.
New River	2,736,735	118,802	2,855,537
Kanawha	2,053,377	11,956	2,065,283
Kentucky	133,071	93	133,164
Connecting lines	25,155	16,220	41,375
Total	4,948,288	147,071	5,095,359
Total, 1908	4,141,892	79,570	4,221,462

Deliveries this year to points west of mines, 2,587,208 tons coal and 62,682 coke; points east, 577,047 tons coal and 84,389 coke; tidewater, 1,781,706 tons coal; anthracite to line points, 2317 tons. Total increase in shipments this year, 873,897 tons.

Coal tonnage passing through Sault Ste. Marie canals, season to Dec. 1, short tons:

	1908.	1909.	Changes.
Anthracite	1,260,753	1,362,037	I. 101,284
Bituminous	8,254,306	8,235,454	D. 18,852
Total	9,515,059	9,597,491	I. 82,432

Only a few cargoes passed in December, so that the above figures represent nearly the season's business.

Coal receipts at Boston, 11 months ended Nov. 30, reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite	1,619,800	1,606,294	D. 13,506
Bituminous	2,971,968	3,215,663	I. 243,695
Total domestic	4,591,768	4,821,957	I. 230,189
Foreign	338,808	214,106	D. 124,702
Total	4,930,576	5,036,063	I. 105,487

The foreign coal is almost all from Nova Scotia.

New York

Anthracite

Dec. 15—The anthracite trade has been started into greater activity by the cold weather which has prevailed during the past week. Dealers are hustling to get in supplies, and trade is good.

Schedule prices for large sizes are $4.75 for lump and $5 for egg, stove and chestnut, f.o.b., New York harbor. For steam sizes quotations are, f.o.b., New York harbor points: Pea, $3.10@3.25; buckwheat, $2.35@2.50; No. 2 buckwheat or rice, $1.75@2; barley, $1.35@1.50. Some washery pea and buckwheat have been offered at 10 or 15c. less.

Bituminous

The local bituminous trade is more active and there has been considerable buying, both in New York harbor and at points along the Sound. All-rail trade continues steady, as it has been for some time past. The Far East, owing to the season, is getting to be less and less a factor in the market.

Prices are advancing, but are still irregular. A fair grade of steam coal can be had at a seaboard price which realizes about $1 per ton at mine, while better grades run up to $1.40 at mine and in some cases $1.50 at mine is paid for special coals. A peculiar situation has developed in gas coal. The shipments of lump and ¾-in. have been so light that comparatively little slack has been made, the result being a scarcity of that grade. During the past week prices have been paid for slack which are on a parity with those for lump and run-of-mine.

Car shortage is still with us, and is holding back deliveries. The situation is still particularly bad on the Baltimore & Ohio, but the Pennsylvania is also suffering. Transportation is better, coal coming through about on schedule time.

In the coastwise vessel markets there is talk of higher rates, but no positive advance has been made, although some boats are holding back on account of stormy weather. The current rate from Philadelphia to Boston, Salem and Portland is $1; while from New York it is 70@75c. to points around Cape Cod.

Birmingham

Dec. 13—Coal production in the South is back to the condition that prevailed before the panic came on in 1907 and there is need for every ton. There is a considerable amount of coal going into coke but still the cry is for more coke. There have been some coal-land deals consummated recently which mean development in the near future while some smaller mines have changed hands and are soon to be under better operation than heretofore. The railroad interests have been recently in the market.

Chicago

Dec. 14—With the coldest weather of the season over Chicago territory in the last week, the market for domestic coals has been brisk and sales have been widely distributed. Country and city dealers have bought freely of bituminous and anthracite and it is the opinion of some in the trade that the buying movement, now that it has begun, will continue actively, for both retailers and consumers are believed to have short stocks generally. Others adhere to the idea that the coal market is strictly a weather proposition. As a result of the cold wave, domestic grades of Illinois and Indiana coals strengthened and a better tone has become manifest in the steam trade. Eastern coals have found some betterment in the situation. Transportation has been bad on account of storms and the switchmen's strike, but this affects about all kinds of coal alike.

Illinois and Indiana coals continue to bring $2@3 for lump and egg, $1.75@1.85 for run-of-mine and $0.95@1.15 for screenings. For steam uses lump and run-of-mine are in large and increasing demand, and the amount of coal sold to escape demurrage charges is small.

Of coals from east of Indiana, Hocking is very strong and brings its full circular

price; smokeless is again weak through overshipments and brings 10@25c. less than circular prices; other eastern coals find a fair sale at good prices. Anthracite sells very well in both city and country.

Cleveland

Dec. 13—A cold snap and snowstorm have started up the domestic demand at a lively rate. The steam coal trade is steady and good. Prices remain unchanged, as the closing of the Lake trade has thrown plenty of coal on the local market.

Indianapolis

Dec. 13—Cold weather throughout the West has stirred up domestic trade. Local dealers are making large requisitions on the coal companies and there is much activity at mines in consequence. There is also a good demand from the Northwest and shipments are being made as fast as cars can be had. Some complaints are heard of delay in supplying cars, and if there is no cessation in orders car shortage will become a feature in the trade. Local prices of domestic coal have advanced.

Pittsburg

Dec. 14—Local demand for coal is better on account of the cold weather. The car supply is barely sufficient, with occasional shortages, promising serious interruptions when the weather really becomes bad. Prices are a trifle firmer, while slack is clearly quotable 10c. higher. Regular prices, which are adhered to by practically all interests, are: $1.15 for mine-run and nut, $1.25 for ¾-in. and $1.40 for domestic coal, with slack at 75@85c. per ton.

Connellsville Coke—The market has continued quiet as to actual transactions in both prompt and contract, but negotiations on several contracts for furnace coke are believed to be coming to a head. Buyers have been holding off and have been since it became pretty clear a few weeks ago that the prospective position as to supply and demand would not justify the high prices of $2.90 and $3 which were done on a few contracts for 1910 closed in September and early October. The lowest quoted price of late has been $2.80 on contract furnace coke, but it is possible this may be shaded 5 or 10c. when good contracts are offered. Sales of prompt coke have been light, covering only 2000 tons in the week, all at $2.80 so far as reported. Foundry coke has been quiet, except for odd sales of prompt at $3.10@3.15 at oven.

We quote the market at $2.80@2.90 for prompt or contract furnace coke, and $3@3.25 for prompt and $3.25@3.50 for contract foundry coke.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended Dec. 4 at 444,610 tons, a drop of about 1000 tons, and shipments at 7842 cars to Pittsburg, 8090 cars to points west of Pittsburg and 812 cars to points east of Connellsville, a total of 16,744 cars.

Foreign Coal Trade

German Coal Trade—Exports and imports of fuel in Germany, 10 months ended Oct. 31, metric tons:

	Exports.	Imports.	Excess.
Coal	19,064,296	9,891,418	Exp. 9,172,878
Brown coal	28,794	6,804,261	Imp. 6,775,467
Coke	2,818,294	550,364	Exp. 2,267,930
Briquets	1,308,939	147,030	Exp. 1,161,909
Total	23,220,323	17,393,073	Exp. 5,827,250
Total, 1908	21,735,259	17,545,549	Exp. 4,189,710

Coke exports this year included 30,461 tons to the United States.

German Coal Production—Coal production of the German Empire, 10 months ended Oct. 31, metric tons:

	1908.	1909.	Changes.
Coal	124,560,567	123,611,118	D. 1,949,449
Brown coal	55,086,244	55,762,053	I. 675,809
Total mined	179,646,811	179,373,171	D. 273,640
Coke made	17,650,854	17,637,527	D. 13,327
Briquets made	15,277,972	15,526,980	I. 249,008

Of the briquets reported this year 12,321,073 tons were made from brown coal or lignite.

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, Wales, report prices of coal as follows on Dec. 4: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.66; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.28; seconds, $1.92. All prices are per long ton, f.o.b. shipping port, for cash in 30 days, less 2½ per cent. discount.

Iron Trade Review

The iron and steel markets show the end-of-the-year dullness which is usually expected at this season. Comparatively little will be done before Jan. 1 but most people expect that after that date buying for the third and fourth quarters will set in actively.

Pig-iron sales have been confined chiefly to comparatively small lots of foundry iron which are needed to make up deficiencies. Practically nothing has been done for next year, beyond the first quarter. The December report from the furnaces shows an increased production, the most noticeable point in which is that the gain over last month is entirely from the merchant furnaces, the steel-works stacks showing a slight decrease.

In finished material the market has likewise been quiet, with little new except some sales of structural steel which is needed to fill contracts of considerable size.

At a conference held in Pittsburg the American Federation of Labor has decided to concentrate its forces on an attack on the open-shop policy of the United States Steel Corporation. No immediate action is to be taken, but funds will be raised, and opportunity taken to bring on a conflict as soon as possible. This may be eccepted as a forerunner of serious labor troubles in the future.

Pig Iron Production—The statements of the blast furnaces, as collected by the *Iron Age*, show that on Dec. 1 there were 314 coke and anthracite stacks in blast, having a total weekly capacity of 599,200 tons of pig iron; an increase of 5600 tons over Nov. 1 and of 197,200 tons over Jan. 1 last. In the past three years the highest weekly active capacity reported was 528,200 tons on July 1, 1907; the lowest, 235,150 tons on Jan. 1, 1908. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in November was 2,582,500 long tons; for the 11 months ended Nov. 30 it was 23,041,000 tons.

Lake Superior Iron Ore—Shipments of iron ore from the Lake Superior region by water for November were 4,899,220 long tons, notwithstanding the delay caused by the accident to the Poe lock at the Sault. For the season to Dec. 1 the total shipments were, in long tons:

	1908.	1909.	Changes.
Escanaba	3,351,502	5,748,042	I. 2,396,540
Marquette	1,487,487	2,909,578	I. 1,422,091
Ashland	2,513,670	3,834,285	I. 1,320,615
Two Harbors	5,702,237	9,181,132	I. 3,478,895
Superior	3,564,030	6,540,505	I. 2,976,475
Duluth	8,808,168	13,470,503	I. 4,662,335
Total	25,427,094	41,684,045	I. 16,2,95156

The total this year shows an increase of 395,290 tons over 1907. A few cargoes came out in December, but the quantity was small.

Baltimore

Dec. 13—Exports for the week included 62,065 lb. wire and 211,866 lb. galvanized sheets to Liverpool. Imports included 104 tons manganese ore from Germany; 11,900 tons iron ore from Cuba.

Birmingham

Dec. 13—The Southern pig-iron market continues quiet though a few sales are being made. Inquiries are being received indicating that before long there is going to be a buying movement. The production in Alabama in December will not quite reach the high figure of November, one of the Sloss-Sheffield company's city furnaces having been blown out for repairs with another soon to go out for relining. Reports are current that No. 2 foundry iron is being sold in this section at $14 per ton. Inquiry elicts the information that only resale iron is selling at from $14@14.50, while furnace companies are endeavoring to maintain $15 per ton. The make is not much greater than the needs, old orders considered. There is some inquiry being received from the cast-iron pipe makers.

The consumption of pig iron in the South continues to show improvement. There is steady operation at the steel works.

Chicago

Dec. 14—The iron market continues quiet, with every indication that it will not change materially before the passing of the year. Signs of weakness continue to characterize the market for Southern, but furnace agents profess faith in the maintenance of present prices. No. 2 Southern sells at $14@14.50, Birmingham ($18.35@18.85 Chicago) on the small contracts that are being made for first-half deliveries, considerable resale iron being in the market at the lower figure. Northern iron is firm at $18.50@19, the furnaces being well sold up. There is apparent a feeling that it will do no harm to wait a while until the consumption of iron products has increased and the season for stock taking is over. Buying now is mainly in carload lots to 1000 tons, a larger order appearing but rarely. In iron and steel products there is a continuance of fair sales but no heavy buying, with a firm tone. Coke continues at $5.50 and is in somewhat irregular supply owing to transportation delays.

Cleveland

Dec. 14—The season has finally closed, with stormy weather and an unusually large number of wrecks and casualties. Several ore boats are reported tied up in the ice on Lake Huron, at the head of the St. Clair river. It is now reported that no final action on ore prices will be taken before January.

Philadelphia

Dec. 15—The tone of the pig-iron market is strong, notwithstanding the small amount of business closed during the past few days. Quite a number of large buyers have their inquiries in hand though there is no disposition to bring dealings to a close. Very little business will be done until after the holidays. Northern No. 2 foundry is quoted at $19.50; Southern, $18.50; Northern gray forge, $18; Southern, $17.50; basic, $19.

Steel Billets—Business at present is confined to forging billets on which prices have been again advanced 50 cents.

Bars—Mills are holding prices at the highest point. A further advance is spoken of as probable. The month so far has been rather quiet. The bulk of retailers are now supplied with refined iron for from 30 to 60 days.

Plates—Some interests are endeavoring to arrange for supplies of material for next spring. Prices are creeping up and there is no standard figure. Each contract fixes its own price.

Structural Material—No transactions in structural material have been reported outside of a few small orders for city delivery.

Scrap—The scrap market has been quiet and no sales have been made to the mills.

Pittsburg

Dec. 14—Effective at the close of business Saturday, Dec. 11, wire products were advanced $1 a ton, to 1.65c. base for plain wire, $1.85 base for wire nails, 1.85c. for painted barb wire and 2.15c. for galvanized barb wire. The great reduction occurred May 1, being $8 per net ton on plain wire, $7 on nails and $10 on barb wire. Since then there have been two $2 advances, May 15 and July 24, which with the $1 advance Dec. 11 make a total of $5, leaving plain wire $3, nails $2 and barb wire $5 below the prices ruling, at least nominally, from the $2 reduction on June 9, 1908, to May 1 last. The general expectation in the trade had been that there would be a $2 advance Jan. 1 next, and with the $1 advance just made, the expectation is there will be another $1 advance about Jan. 15. These prices refer to the jobbing trade, with which contracts are customarily made covering specifications to be filed within 60 days. Manufacturers who buy plain wire are covered farther ahead, and a couple of months ago producers started covering them for the first half of the new year at 1.70c., or at an advance of $2 a ton over prices then ruling for early delivery. The wire advance will stimulate specifications from jobbers on contracts already placed. Specifications had been rather light, as all contracts taken prior to the previous advance had been worked off. The wire mills have been running fairly full, but have been accumulating stocks.

Pig Iron—The market has been very quiet as to actual transactions. Most of the large steel works which bought bessemer iron heavily in the past few months are asking for January iron to be delivered at once, and bessemer iron is scarce. One merchant producer has been bidding for bessemer iron in the market, to apply on contracts, and has made one purchase, of 3500 tons, at $19, Valley, for prompt shipment. Basic is relatively weak, with no demand. It is quoted at $17, Valley, but some heavy buying will probably have to be done after the first of the year. Foundry and forge irons are dull and neglected, the market being quotable at $17@17.25 on foundry and $16.25@16.50 on forge, depending on delivery. The weakness in Southern iron has not affected this market, since even at $14, Birmingham, which it is believed can be done on prompt iron, the delivered price Pittsburg would be $18.90, while Valley iron at $17 at furnace makes $17.90, Pittsburg. Some Southern producers are understood to be willing to do $14.50, Birmingham, the $14 iron being offered by speculative interests, and the $14.50 price could probably be done for the fore part of 1910.

Steel—The supply of unfinished steel has eased up a trifle, but offerings are still limited and prices high. Billets are quotable at $27.50@28 for bessemer and $28@28.50 for open-hearth, with sheet-bars at $28.50@29.50, all f.o.b. maker's mill, Pittsburg. Only odd lots of sheet-bars are available at the lower price.

Ferromanganese—The market has been quiet, with a strong tone, but with no evidence of the extreme advance which some interests professed to expect. Prompt material is quotable at $45@45.50, and first quarter or half at $45.50@46, f.o.b. Baltimore, the freight to Pittsburg being $1.95 per ton.

Sheets—Prices are firm, with mills sold pretty well through the first quarter. The market stands at 2.40c. for black, 3.50c. for galvanized, $1.70 for painted corrugated and $3 for galvanized corrugated.

Metal Markets

New York, Dec. 15—The metal markets generally show little change from recent reports. There is, in most metals, a good business, but no important changes in quotations. Lead has risen while spelter has fallen.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Oct. 1909..	$ 9,379,402	$ 7,034,164	Exp. $ 2,245,438
" 1908..	1,952,574	3,785,705	Imp. 1,833,131
Year 1909..	106,652,236	38,139,557	Exp. 68,512,679
" 1908..	70,889,954	42,213,678	" 28,676,276
Silver:			
Oct. 1909..	4,053,745	4,017,884	Exp. 35,861
" 1908..	4,378,015	3,746,863	" 631,652
Year 1909..	47,342,861	37,258,414	" 10,084,447
" 1908..	43,159,395	34,539,067	" 8,620,328

Exports from the port of New York, week ended Dec. 11: Gold, $1,978,000, chiefly to Argentina; silver, $538,432, principally to London. Imports: Gold, $77,576; silver, $340,186, chiefly from Mexico and South America.

Gold—Supplies of gold on the open market in London were divided between the Bank of England and Continental banks. The price was 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for coin. Some more gold for South America was taken in New York.

Platinum—Business continues very good and dealers are holding prices steady at $29.50 per oz. for refined platinum and $33.50 per oz. for hard metal. There has been some increase lately in imports from Colombia.

Our special correspondent writes from St. Petersburg, under date of Nov. 25, that demand is good, especially from Paris, and there has been a further advance in prices. At Ekaterinburg small dealers and producers sell crude metal, 83 per cent. platinum, at 6.25 rubles per zolotnik—equal to $23.50 per oz. At St. Petersburg quotations for the same grade are 24,000@24,500 rubles per pood—equal to an average of $23.77 per oz. Still higher prices are expected and dealers are not pressing sales.

Silver—The silver market has shown considerable firmness and activity this week. It has been a rising market. Continental orders are supposed to be responsible for the advance. The market closes easier today.

SILVER AND STERLING EXCHANGE

Dec.	9	10	11	13	14	15
New York....	51⅞	52	52	52⅛	52⅞	52⅜
London.....	23⅞	24	23⅛	24⅛	24⅛	24⅛
Sterling Ex..	4.8775	4.8775	4.8775	4.8775	4.8780	4.8790

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Dec. 2, as reported by Messrs. Pixley & Abell:

	1908.	1909.	Changes.
India.....	£ 8,369,640	£5,955,500	D. £2,414,140
China.....	571,400	1,829,300	I. 1,257,900
Straits.....	164,885	114,614	D. 50,271
Total.. ...	£ 9,105,925	£7,899,414	D. £1,206,511

Indian exchange in London, 16.125d. per rupee, average for the week.

Copper, Tin, Lead and Zinc

Dec.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
9	13¾ @13¾	13¼ @13¾	59½	32¾ @32½	4.40 @4.50	4.35 @4.37½	6.10 @6.12½
10	13½ @13¾	13¼ @13¾	59¾	32¾ @32½	4.47½ @4.50	4.37½ @4.40	6.10 @6.12½
11	13½ @13¾	13¼ @13¾	....	32⅛ @32¾	4.50	4.40	6.10 @6.12½
13	13¼ @13¾	13¼ @13¾	60¼	32⅜ @32⅞	4.50	4.40	6.07½ @6.10
14	13¼ @13¾	13¼ @13¾	60	32½ @32¾	4.50	4.40	6.07½ @6.10
15	13¼ @13¾	13¼ @13¾	59¼	32½ @32¾	4.55 @4.60	4.40 @4.45	6.07½ @6.10

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—While a good business has been reported for some special brands of Lake copper, the general character of the market has not changed. Business has been in relatively small volume and the demand is readily met at the current quotations. Special brands of Lake have sold as high as 13⅞c. Some sales of electrolytic for domestic delivery have been made at 13½, delivered, 30 days, equivalent to a little less than 13⅜c., cash, New York, but the bulk of the business has been at 13⅜c., delivered, 30 days, and plenty of copper is offered at that price. In the early part of the week some fair size sales for delivery in Europe were made at prices netting less than 13⅛c., but toward the close sales for foreign delivery were made on about the same basis as domestic. The close is steady at 13⅝@13¾c. for Lake copper, and 13⅛@13⅜c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 13@13¼c. for the week.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill. Business is fair.

The standard market in London developed a great deal of strength upon the report that an agreement had been reached among the American producers to curtail their production. On Monday prices stood about £1 higher than the closing quotation reported in this issue last week, but since then realizing has taken place which wiped out more than one-half of the improvement, the close being cabled weak at £59 10s. for spot and £60 10s. for three months.

Refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £62 10s.@£63 10s.; strong sheets, £73 10s.@£74 10s. per ton.

Exports of copper from New York and Philadelphia for the week were 7511 long tons. Our special correspondent gives exports from Baltimore at 480 tons copper.

Copper Producers' Association—The reports give the following figures for November and the 11 months ended Nov. 31, in pounds of fine copper:

	November.	Eleven Mos.
Stocks, Nov. 1 and Jan. 1.....	153,509,626	122,357,266
U. S. production.....	121,618,369	1,287,574,401
Total supplies.....	275,127,995	1,409,931,667
Deliveries, domestic...	66,857,873	636,647,395
Deliveries, export.....	55,266,595	620,280,745
Total deliveries.....	122,124,468	1,256,928,140
Stocks, Dec. 1.....	153,003,527	153,003,527
Inc. or dec. in stocks	D. 506,099	I. 30,646,261

United States production includes all copper refined in the United States, whether from domestic or foreign material. Production for the 11 months exceeded deliveries by 30,646,261 lb., with a corresponding increase in stocks.

Tin—Operations for the bull account have been on a very large scale in the London market. The operators appear to be very confident of their position, predicating their predictions of a further improvement upon the excellent statistical position of the metal and the favorable outlook for a continued large consumption in this country. Consumers have not participated in the movement, but as they are not covered ahead there has been a steady influx of orders for early delivery. The London market closes firm at £148 10s. for spot, and £149 15s. for three months, while business in the New York market has taken place at 32½@32¾ cents.

Lead—The American Smelting and Refining Company on Dec. 9 announced an advance in price for desilverized, effective Dec. 10, and the demand being good the market for common brands of lead followed suit. On Dec. 15 the smelting company announced a further advance to 4.60c. The close is firm at 4.55@4.60c., New York, and 4.40@4.45c. St. Louis.

The London market has been somewhat firmer and the close is cabled at £13 1s. 3d. for Spanish lead, and £13 3s. 9d. for English.

Spelter—As a result of a lull in the demand, some little spelter is accumulating at the smelting centers, and it is reported that occasional lots have been sold at below current quotations. Business is so light that it is difficult to fix quotations, the close being reported nominal at 6.07½@6.10c. St. Louis, and 6.22½@6.25c. New York.

New York quotations for spelter Dec. 9-11, inclusive, were 6.25@6.27½c.; Dec. 13-15, inclusive, 6.22½@6.25 cents.

The London market is slightly higher at £23 2s. 6d. for good ordinaries and £23 7s. 6d. for specials.

Base price of sheet zinc is now 8c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Antimony—Business is extremely dull, and no change is looked for until the new year opens. In the absence of sales, prices are nominally unchanged. Cookson's is quoted at 8⅜@8½c. per lb.; Hallett's, 8@8⅛c.; U. S., 7⅞@8c.; with 7⅝@7¾c. named for outside brands.

Aluminum—The price of aluminum is unchanged at 20@23c. per lb. for ingots. The higher price is that asked by the American producer.

Quicksilver—The market is quieter, but strong and steady. The New York quotation is $52.50 per flask of 75 lb. for large lots; for small lots 72@75c. per lb. is asked by jobbers. The San Francisco quotation is $50.50@51.50 per flask for domestic orders, and $2 less for export. The London price is £9 15s. per flask, with £9 17s. 6d. asked by jobbers.

German Metal Imports and Exports

Imports and exports of metals—other than iron—in Germany, nine months ended Sept. 30, in metric tons:

	Imports.	Exports.	Excess.	
Copper.....	130,942	48,790	Imp.	82,152
Copper, 1908...	134,137	52,648	Imp.	81,489
Tin.....	10,012	5,529	Imp.	4,483
Tin, 1908.....	10,687	4,439	Imp.	6,248
Lead.....	54,611	30,797	Imp.	23,814
Lead, 1908.....	55,493	31,587	Imp.	23,906
Zinc.....	33,020	75,287	Exp.	42,267
Zinc, 1908.....	24,303	68,667	Exp.	44,364
Nickel.....	2,373	1,370	Imp.	1,003
Nickel, 1908....	2,354	1,290	Imp.	1,064
Aluminum.....	5,918	1,255	Imp.	4,663
Aluminum, '08.	2,364	857	Imp.	1,507
Miscellaneous....	851	7,733	Exp.	6,882
Miscellan's, '08	705	7,242	Exp.	6,537

The figures include alloys and manu-

factures of the several metals. Imports and exports of ores—other than iron—for the nine months, were, in metric tons:

	Imports.	Exports.	Excess.
Gold ore	122	.....	Imp. 12 2
Gold ore, 1908	139	.....	Imp. 139
Silver ore	1,118	.....	Imp. 1,118
Silver ore, '08	1,529	5	Imp. 1,524
Copper ore	16,299	16,838	Exp. 539
Copp'rore, '08	13,484	17,524	Exp. 4,040
Tin ore	11,127	23	Imp. 11,104
Tin ore, 1908.	8,078	27	Imp. 8,051
Lead ore	87,961	1,577	Imp. 86,384
Lead ore, '08	95,823	898	Imp. 94,925
Zinc ore	153,044	35,285	Imp. 117,759
Zinc ore, 1908	137,873	26,045	Imp. 111,828
Nickel ore	10,100	.....	Imp. 10,100
Nickel ore, '08	7,780	.....	Imp. 7,780
Chrome ore	19,037	5,021	Imp. 14,016
Ch'me ore '08	11,451	115	Imp. 11,336
Pyrites	506,261	9,505	Imp. 496,756
Pyrites, 1908.	510,348	13,118	Imp. 497,230
Miscellaneous.	4,389	501	Imp. 3,888
Mis., 1908	3,625	533	Imp. 3,092

Miscellaneous ores include uranium, molybdenum, tungsten and other minor metals, with some mixed or complex ores.

Imports of slag and slag products were 428,792 tons in 1908, and 360,370 tons in 1909; exports, 56,736 tons in 1908, and 47,605 tons this year.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 11—The highest price paid this week for zinc ore was $52.50; the base price, 60 per cent. zinc, was $49@51 per ton. The base price paid for lead ore was $54 per ton.

SHIPMENTS, WEEK ENDED DEC. 11.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	624,035	62,500	218,600
Mineral Point	470,000	.....	.....
Days Siding	314,000	.....	.....
Highland	254,000	.....	.....
Benton	251,420	.....	.....
Cuba City	234,370	86,725	141,040
Galena	176,000	.....	95,000
Linden	66,890	.....	.....
Total	2,390,715	149,225	454,640
Year to Dec. 11	130,707,375	8,917,655	14,890,755

In addition to the above there was shipped to the separating plants, Platteville, Galena and Mineral Point, 1,985,162 lb. zinc concentrates.

Joplin, Mo., Dec. 11—The highest price paid for zinc ore was $54.50, the assay base for zinc-sulphide ore being $50@52 per ton of 60-per cent. zinc. Zinc silicate sold on a base of $28@30 per ton of 40-per cent. zinc. The average price, all grades, was $48.04. The highest price paid for lead ore was $54, and very little ore sold at a less price. The average price, all grades, was $53.98 per ton.

The severe cold weather proved disastrous to mining everywhere except in the sheet-ore area. The shipment was decreased 3200 tons of zinc ore compared with the previous week. It was necessary to blast the ore from the bins, where loading was done. The weather moderated Friday, but there is evidence tonight of another cold wave coming. Despite the unfavorable weather the price of zinc ore was lowered a little here and there, in preparation for a general decline expected next week.

SHIPMENTS, WEEK ENDED DEC. 11.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,392,150	556,940	$101,536
Joplin	1,301,560	162,460	38,877
Miami	645,210	.....	14,194
Duenweg	397,920	90,210	12,170
Galena	440,670	36,040	11,989
Alba-Neck	432,220	.....	11,237
Prosperity	157,660	235,530	10,379
Granby	498,300	.....	8,715
Aurora	345,820	.....	7,115
Quapaw	218,880	.....	5,253
Oronogo	130,840	54,930	4,754
Spurgeon	226,090	7,250	4,278
Peoria	279,730	.....	3,816
Carthage	130,390	.....	3,388
Sarcoxie	117,671	.....	2,824
Carl Junction	55,040	.....	1,486
Seneca	47,050	.....	658
Totals	8,817,200	1,143,360	$242,671
50 weeks	569,818,650	84,123,930	$13,950,529
Zinc value, the week, $211,807; 50 weeks,			$11,657,526
Lead value, the week, 30,864; 50 weeks,			2,293,003

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	44.15	32.07	40.35	60.48	67.52
July	34.55	43.06	31.67	41.11	59.90	53.74
August	36.53	48.25	33.42	44.54	60.34	57.60
September	37.63	47.70	34.44	44.87	54.59	56.11
October	35.95	49.50	33.28	45.75	52.63	55.02
November	39.13	51.31	35.02	48.29	54.53	53.94
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.99	.....

NOTE—Under zince ore the first two columns give base prices for 60 per cent. zinc ore: the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Petroleum

Production and shipments of petroleum for the month of November are reported by the *Oil Investor's Journal* as below, in barrels of 42 gal. each:

	Production.	Shipments.
Oklahoma	3,716,353	3,682,489
Southeast Texas	675,866	1,114,774
Louisiana	252,472	201,751

New wells completed in November were: Oklahoma, 141 oil and 9 gas; Southeast Texas, 31 oil; Louisiana, 6 oil and 3 gas. Stocks of Oklahoma oil were 56,809,815 bbl. at the end of the month.

Chemicals

New York, Dec. 15—The general market is reported firm as to prices, with a fair business in most lines, and deliveries on contracts well taken.

Copper Sulphate—Business is quiet and quotations unchanged at $4 per 100 lb. for carload lots and $4.25 per lb. for smaller consignments.

Arsenic—Consumers seem to be pretty well stocked; at the same time sellers are not urgent, apparently looking for better prices. Quotations are unchanged at 2¾@2⅞c. per lb. for white arsenic.

Nitrate of Soda—There is nothing new in this article, which is still held at 2.07½c. per lb. for spot and 2.10c. per lb. for futures.

Sulphate of Ammonia—The removal of duty has resulted in an increase of imports. For the 10 months ended Oct. 31 these were 45,558,062 lb. in 1908, and 62,583,604 lb. in 1909. Of this year's imports 16,484,311 lb. have come in since the new tariff took effect.

Mining Stocks

New York, Dec. 15—The general stock market has shown signs of improvement during the past week and quotations have been at a little higher range. It is still largely a traders' market, but many brokers insist that the public is more in evidence than it has been for some weeks past. United States Steel common is strong again and in good demand, while Amalgamated Copper also advanced. The anthracite-coal stocks were noticeably strong.

On the Curb the copper stocks followed the lead of the Exchange and there were several advances. The reported consolidation of the Guggenheim coppers was variously received. At the close there was some irregularity, with declines in a few stocks. The Nevada gold stocks are still rather neglected. Cobalt shares were a little stronger but were inclined to be heavy at the close.

Boston, Dec. 14—The local market has been one of specialties the past week. Prices have maintained a strong front, with but few exceptions. Business has been of fair volume and temperament is optimistic, although nothing great is looked for in the market until the turn of the year. North Butte had a $5.12½ break to $54.87½ on profit-taking although considerable manipulation entered into the trading. A recovery to $57.25 followed this, although the closing today was near the lowest. It is believed that inside selling caused the decline.

Hancock mining is attracting attention and has risen $8.62½ during the week to $29.37½. As a matter of fact the price has more than doubled within the past few weeks and it is spoken of in some circles as a second Lake or Superior mine.

The expected merger of the Boston Consolidated and the Nevada Consolidated with Utah Copper has given a good market to these specialties, especially to the first named, which rose $2.25 to $23.50. Report has it that Boston Consolidated stockholders will be called upon to contribute $2 per share for the privilege of exchanging their shares into Utah Copper on the basis of 2½ Boston for one Utah.

Amalgamated has shown only slight changes during the week, although it holds firm. Activity developed in American Zinc, which rose $4 to $39; and in U. S.

Smelting, which rose $3.12½ to $56.12½. The former is approaching dividend payments and the latter is making big earnings.

On the Curb, prices have been firm. Davis-Daly had a weak period and Ohio Copper has strengthened. Cactus rose to $5 and Chino has been an active and strong feature.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
I	112,135,200	51,862,624	38,499,797
II	103,700,817	43,578,118	30,968,496
III	117,058,661	48,871,964	59,191,043
IV	113,574,292	47,546,010	65,110,111
V	118,356,146	61,163,325	70,542,753
VI	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018,974
VIII	120,597,234	59,614,207	48,382,704
IX	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII			

VISIBLE STOCKS.

	United States.	Europe.	Total.
I	122,357,266	124,716,480	247,073,746
II	144,130,045	118,574,400	262,704,445
III	173,284,248	117,140,800	290,425,048
IV	182,279,902	115,024,000	297,303,902
V	183,198,073	114,050,320	297,248,393
VI	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	52.538	24.760	24.166
July	53.115	51.043	24.514	23.519
August	51.683	51.125	23.858	23.588
September	51.720	51.449	23.877	23.743
October	51.431	50.923	23.725	23.502
November	49.647	50.703	22.933	23.351
December	48.766	.....	22.493	...
Total	52.864	.....	24.402	

New York, cents per fine ounce; London, ounce per standard ounce.

COPPER

	New York. Electrolytic 1908.	New York. Electrolytic 1909.	New York. Lake. 1908.	New York. Lake. 1909.	London. 1908.	London. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56¼	12.928	12.93¾	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	13.214	12.877	13.548	57.842	59.627
July	12.702	12.880	12.933	13.363	57.989	58.556
August	13.462	13.007	13.639	13.296	60.500	59.393
September	13.388	12.870	13.600	13.210	60.338	59.021
October	13.354	12.700	13.646	13.030	60.139	57.551
November	14.130	13.125	14.386	13.354	63.417	58.917
December	14.111	.....	14.411	.....	62.943	...
Year	13.208	.....	13.424	.....	59.902	...

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	29.125
February	28.978	28.290	August	29.942	29.966
March	30.577	28.727	September	28.815	30.293
April	31.702	29.445	October	29.444	30.475
May	30.015	29.225	November	30.348	30.859
June	28.024	29.322	December	29.154	
			Av. year	29.465	

Prices are in cents per pound.

LEAD

Month.	New York. 1908	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	4.350	4.291	12.600	13.031
July	4.744	4.321	4.188	13.000	12.563
August	4.580	4.363	4.227	13.375	12.475
September	4.515	4.342	4.215	13.125	12.781
October	4.351	4.341	4.215	13.375	13.175
November	4.330	4.370	4.252	13.538	13.047
December	4.213	.....	.....	13.166	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.518	5.141	4.363	4.991	20.563	21.225
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	5.402	4.393	5.252	19.000	22.000
July	4.485	5.402	4.338	5.252	19.031	21.969
August	4.702	5.729	4.556	5.579	19.350	22.125
September	4.769	5.796	4.619	5.646	19.563	22.906
October	4.801	6.199	4.651	6.043	19.750	23.200
November	5.059	6.381	4.909	6.231	20.875	23.188
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

STOCK QUOTATIONS

NEW YORK Dec. 15 Name of Comp.	Clg.
Amalgamated	87¼
Anaconda	49¾
Balaklala	‡2
Braden	4⅞
British Col. Cop.	7⅛
Buffalo Mines	3½
Butte Coalition	20
Colonial Silver	‡⅛
Combination Fra.	.46
Con. Ariz. Sm.	2⅛
Cum. Ely Mining	9
Davis-Daly	5¼
Dominion Cop.	7
El Rayo	2⅞
Florence	2⅞
Furnace Creek	‡.05
Giroux	11¼
Gold Hill	2
Goldfield Con.	8¼
Granby	103
Guanajuato	2
Guggen. Exp	242
Hanapah	‡15
Kerr Lake	8
McKinley-Dar.	.90
Miami Copper	20⅛
Mines Co. of Am.	.55
Montezu. of C. R.	4
Mont. Sho. C	1¾
Nev. Utah M. & S.	1¾
Newhouse M. & S.	3½
Nipissing Mines	10¾
Ohio Copper	6
Old Hundred	½
Pacific Sm. & M.	1⅞
Silver Queen	.25
Stewart	7/8
Tennessee Cop'r.	38
Tri-Bullion	1
United Copper	8
Utah Apex	5⅛
Utah Copper	60½
Yukon Gold	5

‡Last quotation.

BOSTON Dec. 15 Name of Comp.	Clg.
Adventure	6
Allouez	‡55
Am. Zinc	38¾
Arcadian	7¾
Arizona Com.	44
Atlantic	11¼
Boston Con.	21½
Calumet & Ariz.	101
Calumet & Hecla	650
Centennial	38
Con. Mercur	.12
Copper Range	82
Daly-West	8
East Butte	11¾
Franklin	15½
Greene—Can.	12
Hancock	28¾
Isle Royal	26
Keweenaw	4⅝
La Salle	16
Mass	6¾
Michigan	7¼
Mohawk	63
Nevada	27
North Butte	55¾
Ojibway	9¼
Old Dominion	51⅞
Osceola	155
Parrot	29
Quincy	85¾
Rhode Island	10½
Shannon	15¾
Superior	61½
Superior & Bost.	16½
Superior & Pitts.	16½
Tamarack	64
Trinity	10
U. S. Smg. & Ref	55¼
U.S.Sm. & Re., pd	53
Utah Con.	44⅞
Victoria	4¾
Winona	10
Wolverine	145
Wyandotte	2¾

‡Last quotation.

N. Y. INDUSTRIAL	Low.
Am. Agri. Chem.	46
Am. Smelt. & Ref.	100⅝
Am.Sm. & Ref., pf.	112
Colo. Fuel & Iron.	52
Federal M. & S., pf.	88
National Lead	87¾
National Lead, pf.	110¼
Pittsburg Coal	27⅜
Republic I. & S.	46¾
Republic I. & S., pf.	107
Sloss-Sheffield	87½
Standard Oil	667
U. S. Steel	91⅛
U. S. Steel, pf.	125⅝
Va. Car. Chem.	50⅛

BOSTON CURB	Low.
Ahmeek	‡220
Chemung	‡15½
Chino	10¼
Gila	7
Indiana	7¾
Mason Valley	1⅛
Ray Central	2⅛
Ray Con.	23¾
San Antonio	‡9¾
Yuma	1⅜

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Dec. 11 N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.09	.07
Center Cr'k	2.00	1.75
Cent.C.&C.	86.00	85.00
C.C. & C. pf.	85.00	84.00
Cent. Oil	115.00	100.00
Columbia	8.00	7.00
Con. Coal	19 00	17 00
Doe Run	110.00	100.00
Gra. Bimet.	.35	.30
St. Joe	12.50	11.00

LONDON Dec. 15 Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 7 6
Esperanza	2 14 6
Tomboy	0 19 3
El Oro	1 5 10½
Oroville	0 10 9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Dec. 8.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Bid.
COMSTOCK STOCKS	
Belcher	1 00
Best & Belcher	66
Caledonia	.47
Challar	.26
Comstock	.30
Con. Cal. & Va.	.95
Crown Point	.95
Exchequer	‡ 43
Gould & Curry	.29
Hale & Norcross	.48
Mexican	1.55
Ophir	1.75
Overman	.60
Potosi	.60
Savage	.47
Sierra Nevada	50
Union	.63
Utah	09
Yellow Jacket	1 15
TONOPAH STOCKS	
Belmont	.65
Extension	.47
Golden Anchor	...
Jim Butler	10
MacNamara	29
Midway	.18
Montana	.85
North Star	.02
Tono'h Mine of N.	7.37½
West End Con	24
GOLDFI'D STOCKS	
Adams	.01
Atlanta	10
Blue Bell	02
Booth	.09
C.O.D. Con	.06
Columbia Mt.	05
Comb. Frac.	.45
Cracker Jack	01
Dia'dfield B. B. C.	.01
Florence	2.62½
Goldfield Belmont	04
Goldfield Daisy	.08½
Great Bend	03
Jumbo Extension	11
Kendall	02
Lone Star	.02
May Queen	04
Oro	02
Red Hill	.03
Sandstorm	05
Silver Pick	.08
St. Ives	.05
Triangle	01
BULLFROG STOCKS	
Gibraltar	02
Homestake King.	01
Mont. Shoshone C.	1 00
Tramp Cons.	.04
MISCELLANEOUS	
Cumberland Ely.	8.00
Giroux	11.00
Greenwa'r Copper	.08
Nevada Con.	26.87½
Nevada Hills	.70
Nevada Smelting.	1.00
Nevada Wonder	.60
Nevada-Utah	1.31¼
Penn-Wyoming	.
Pittsburgh S. Pk.	.78
Ray Central	2.75
Ray Con	23.00
Round Mt. Sphinx	.05

COLO. SPRINGS Dec. 10 Name of Comp.	Clg.
Acacia	.07¾
C. C. Con.	.03¼
Dante	.07½
Doctor Jack Pot	.07¾
Elkton	.72
El Paso	.60½
Findlay	.09½
Gold Dollar	.12
Gold Sovereign	.05
Isabella	19¾
Jennie Sample	.08
Jerry Johnson	.08
Lexington	‡.48½
Mary McKinney	.48
Old Gold	‡.04½
Pharmacist	.03½
Portland	.83
U. G. M.	.09
Vindicator	.72¾
Work	.06½

Assessments

Company.	Delinq.	Sale.	Amt.
Arcadian Copper, Mich.	.....	Mar. 1	$0.50
Boston Ely, Nev.	Dec. 23	.....	0.50
Camp Bird Min. Co., Colo.	Dec. 13	.....	0.002
Chemung Copper, N. M.	Jan. 1	Jan. 2	1.00
Con. Virginia, Nev.	Dec. 20	Jan. 10	0.25
Crown Point, Nev.	Nov. 30	Dec. 20	0.10
Exchequer, Nev.	Dec. 15	Jan. 5	0.05
Gordon M. & M., Utah	Jan. 15	Feb. 4	0.002
Hancock Min., Mich.	.....	Feb. 1	1.00
Mexican, Nev.	Dec. 6	Dec. 29	0.10
Mineral Flat, Colo.	Dec. 11	Jan. 6	0.01
Mountain Dell Con., Utah	Dec. 21	Jan. 10	0.01
Palmyra G. & C., Utah	Dec. 29	Jan. 19	0 002
Reindeer C. & G., Ida.	Dec. 31	Jan. 19	0.003
Seven Bros.-Pioche, Nev.	Jan. 15	Feb. 4	0.002
Sheridan M. & M., Ida.	Nov. 20	Dec. 20	0.002
Silver Hill, Nev.	Dec. 23	Jan. 14	0 05
Union Con., Nev	Dec. 22	Jan. 13	0.10
Utah Ideal, Utah	Feb. 1	Feb. 20	0.00½
Winona, Mich.	Dec. 1	Jan. 1	1.00
Yellow Jacket, Nev	Nov. 18	Dec. 22	0.10